

TURNING UNCERTAINTY INTO USEFUL INFORMATION FOR CONSERVATION DECISIONS

SE CSC FACT SHEET 2016-02

UNCERTAINTY IS ALWAYS PRESENT in conservation and other socio-ecological decisions, which can make choices uncomfortable and challenging. All choices have consequences – including the choice to do nothing. This fact sheet discusses the pervasiveness of uncertainty, the importance of understanding varying perceptions of uncertainty, and avenues for progress in the presence of uncertainty and differing risk tolerances.

Our goal is to support **conservation** decisions that are robust to societal and ecological uncertainties.

THE UMBRELLA EXAMPLE: It's 6:00 am. You look, bleary-eyed, out the window to see a calm sky with some clouds in the distance. You get up, get dressed, and prepare for the day. You pack your bag, grab your coffee, and head towards the door. You pause at the sight of your umbrella. Should you bring it? You quickly weigh the options of unnecessarily carrying the umbrella all day versus potentially getting rained on...

This familiar scenario demonstrates three things:

- we regularly face choices that require us to weigh the expected costs and benefits associated with different options;
- rarely are we absolutely certain about what will happen in the future; and
- imperfect information, by itself, does not prevent us from making choices.

We move forward and take on the day. Sometimes it storms.

IN A NUTSHELL...

UNCERTAINTY IS
PERVASIVE
see page 2

PERCEPTIONS OF
UNCERTAINTY VARY
see page 3

PROGRESS
CAN BE MADE
DESPITE UNCERTAINTY
see page 4

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CORRESPONDING INVESTIGATOR:

Brian Irwin, PhD

CO-DEVELOPERS:

Brian Crawford, Tara Gancos Crawford,
Clinton Moore

PHOTOGRAPHY BY:

Alan Cressler, Brian Crawford,
Arnold Brunell

SOUTHEAST CLIMATE SCIENCE CENTER

PROJECT WEB PAGE:
tinyurl.com/secsc-uncertainty

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PERVASIVENESS: UNCERTAINTY IS UBIQUITOUS IN CONSERVATION ISSUES

QUICK GUIDE: COMMON SOCIO-ECOLOGICAL UNCERTAINTIES

Uncertainty implies imperfect information, which produces risk for decision makers. Both societal and ecological uncertainties can influence decisions by affecting what would be considered the “best” choice. On the other hand, a decision is sometimes relatively insensitive to a remaining unknown. The role of uncertainty in decision making often can be qualitatively assessed by simply asking: How would the decision change if the uncertainty were reduced?

SOCIETAL UNCERTAINTY

LINGUISTIC UNCERTAINTY

- Unknown meaning of vague language in either print or spoken form
- Usually *reducible* via additional communication
- Example: People interpret “vulnerability” differently, depending on understanding of risk exposure, sensitivity, and resilience

PSYCHOLOGICAL UNCERTAINTY

- Unknown values, world views, attitudes, or emotions that affect choices or policies
- Potentially *reducible* via communication; often dynamic and difficult to predict
- Example: Tolerance of risks associated with longer periods of drought may differ among individuals, even if objectives are shared

ECOLOGICAL UNCERTAINTY

SYSTEM UNCERTAINTY

- Unknown structure or function of a system
- Often *reducible* through use of competing models that represent the observed phenomena and gathering more data
- Example: Different models predict different intensity and trajectory for an approaching hurricane

ALEATORY UNCERTAINTY

- Unexplained (seemingly random) variation in the natural world
- Relatively *irreducible* with currently available technologies, money, or time
- Example: Daily precipitation is expected to continue to vary, even if seasonal precipitation is expected to decrease on average

PERCEPTIONS: UNCERTAINTY VARIES IN HOW IT IS INTERPRETED AND USED

TREATMENT OF UNCERTAINTY

Why do people who share a common goal make different choices, even when presented with identical information?

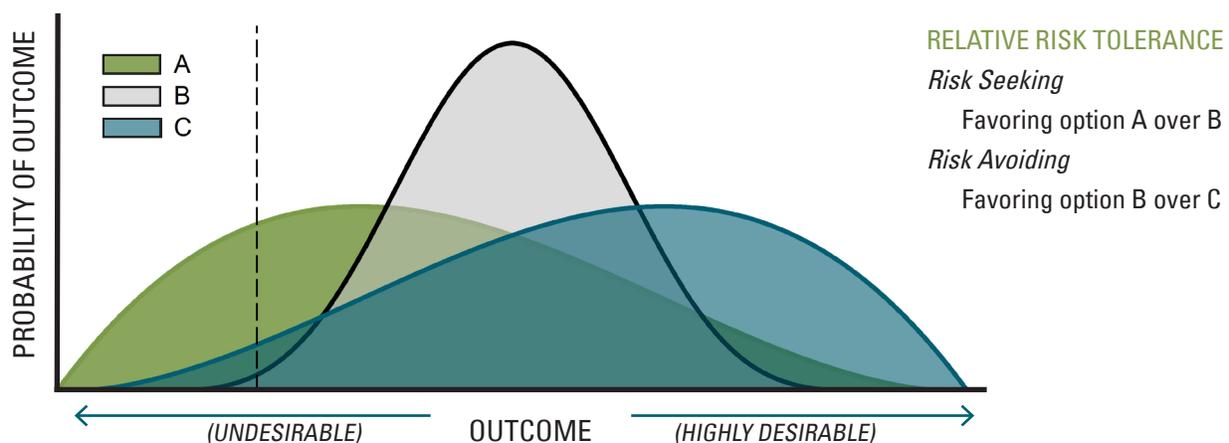
- Our individual and collective responses to uncertainty are likely shaped by our tolerance to risk; attitudes can range from risk-avoiding to risk-seeking.
- Individual world views or values, which may be shaped by one's psychology, experience, education, culture, politics, or religion, may further influence how different types of uncertainty bear upon a decision and can even be dynamic for an individual decision maker.

Decision makers may use the existence of uncertainty as the reason for 1) doing less, 2) maintaining the status quo, or 3) doing more.

When we view uncertainty from a decision-analysis perspective, the important questions become: How was the decision justified? What risks were treated as acceptable? Whose viewpoints about risk were considered?

APPLYING A DECISION-MAKING PERSPECTIVE TO UNCERTAINTY AND RISK

For decision makers, the perceived risk associated with making a choice can frequently be considered as a combination of the probability of experiencing an outcome and the severity of the outcome.



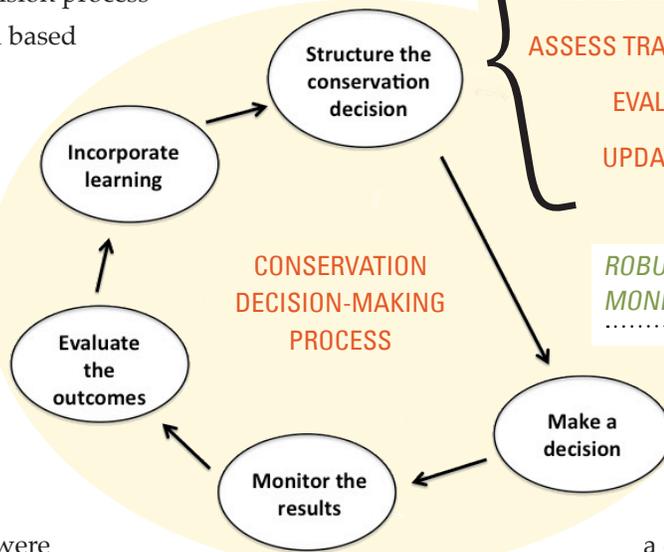
EXAMPLE OUTPUT FROM A DECISION ANALYSIS – Uncertainty leads to distributions of potential outcomes resulting from implementation of three alternative options (A, B, or C). Curve height indicates the probability of observing an outcome if the decision alternative is implemented, and a dashed vertical line represents a minimum threshold, below which we would be considerably unhappy with the outcome of the decision. Option A has the lowest average expected outcome, but a higher probability of a very desirable outcome than B. Option B has a moderate average expected outcome, relatively low uncertainty, and the lowest probability of experiencing conditions below the threshold. Option C has the highest average expected outcome, but a higher probability of a very undesirable outcome than B.

PROGRESS: UNCERTAINTY IS NOT NECESSARILY A ROADBLOCK FOR SCIENCE OR POLICY

FOUR PRINCIPLES FOR ROBUST CONSERVATION DECISION MAKING

1. STRUCTURE THE DECISION

A decision-making process can help navigate the challenges posed by socio-ecological uncertainties. Formalizing decisions typically requires progression through several key steps while also confronting important questions related to both value-based objectives and impartial information. The quality of a decision process will often be judged based on how available information was used, what risks associated with remaining uncertainty were deemed acceptable, what efforts were made to increase knowledge for the future, and how decisions were adjusted based on what was learned over time.



CHECKLIST FOR STRUCTURING DECISIONS

- SPECIFY OBJECTIVES** *What do we hope to achieve?*
- IDENTIFY OPTIONS** *What can we do about it?*
- MAKE PREDICTIONS** *What are the likely consequences?*
- ASSESS TRADE OFFS** *What are the justifiable losses and gains?*
- EVALUATE UNCERTAINTIES** *What are the risks?*
- UPDATE INFORMATION** *What has been learned?*

ROBUST DECISION PROCESSES ARE LIKELY TO INCLUDE MONITORING, EVALUATION, AND LEARNING.

be used to determine how sensitive a decision is to identified uncertainties. Once a decision-relevant uncertainty is recognized, alternative plausible hypotheses should be defined and tested so that the empirical support for competing hypotheses can be established. As new evidence is acquired, incorporating what has been learned should lead to more informed and more justifiable future decisions.

2. RECOGNIZE HOW VALUES MOTIVATE

Even if perfect knowledge were obtainable, decision making would still be driven by value-based objectives. Thus, reconciliation of values and knowledge is required to solve decision problems. Objectives may differ among decision makers or change over time, but they always represent what is considered important.

3. HEED EVIDENCE

Uncertainty arises from incomplete or imperfect information, which limits our ability to forecast accurate and precise expectations for decision outcomes. However, explicit evaluation of what is known and unknown can

4. RECOGNIZE HOW RISK TOLERANCES MAY VARY

Even when objectives are shared, individuals can still react differently to uncertainty. Accounting for uncertainty within a decision-making framework helps make risks more transparent and allows decision makers to find paths towards progressively well-informed future choices. Ultimately, the decision-making process, itself, can be used to affect uncertainty by valuing learning and giving priority to conservation actions that are expected to produce both desirable outcomes and useful information.