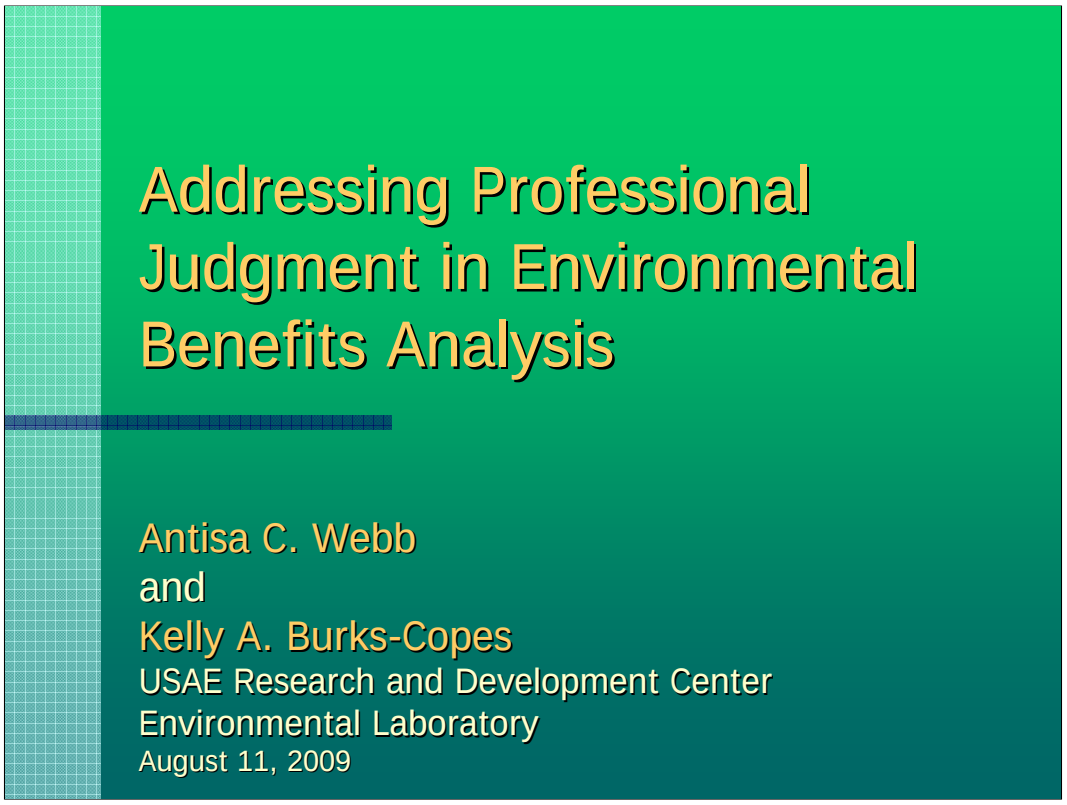


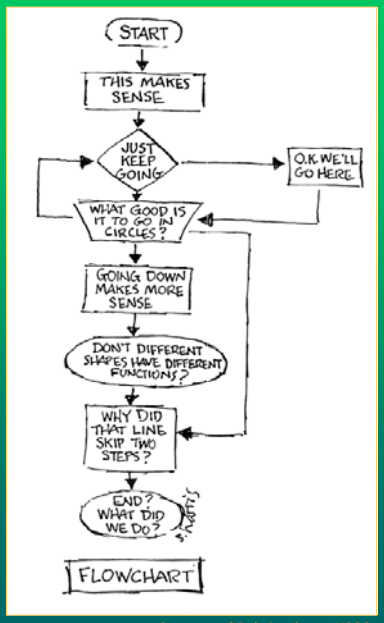
Good afternoon . . . . . My name is Antisa Webb - give bio

And My name is Kelly Burks-Copes – give bio

Today we're going to discuss the "hot topic" of using professional judgment in the analysis of environmental benefits in US Army Corps of Engineers planning studies.

A Road Map for Today

1. What is the problem?
2. What is professional judgment?
3. When is appropriate to use professional judgment?
4. What methods are commonly used?
5. How do we avoid bias?



Courtesy of Rob Jacobson, USGS

The purpose of this webinar is to provide a systematic approach to using and documenting professional judgment in Corps planning studies. A larger comprehensive review of the state of the science has been developed and will hopefully be published in peer reviewed journal soon, and a follow-on tech note with the information presented today has been developed and will soon be released for your reading pleasure.

The following information is not a "how to" manual on the specifics of elicitation techniques *per se* but rather a guide to the fundamental elements that must be considered if professional judgment is to be effectively yet prudently used in the evaluation of environmental benefits.

This message is intended to be firm in principles, yet flexible in details. As such, it is directed at Corps planners and resource managers that need help identifying factors to consider when attempting to use professional judgment.

The discussion today will address five major questions:

1) What is the problem?
2) What is professional judgment itself?
3) When is appropriate to use professional judgment?
4) What methods are commonly used?
5) How do we avoid bias?

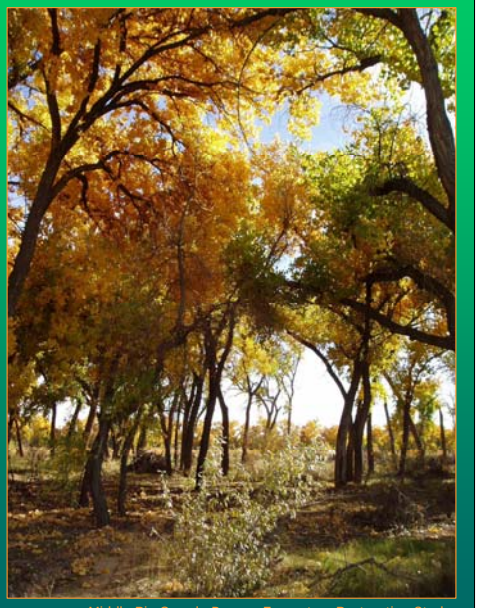
This organization is designed to lead the you through an overview of the role of professional judgment, into the considerations that should be addressed by planning teams, and concluding with useful tools to facilitate applications.

The Problem

"*Too often we enjoy the comfort of opinion without the discomfort of thought.*"

John F. Kennedy

- Unstructured, undocumented professional judgment is being used to "fill the gaps" when ecological models come up short
- Transparency and reproducibility are in question



Middle Rio Grande Bosque Ecosystem Restoration Study
Albuquerque, NM
Kelly A. Burks-Copes

Of late, planners in the Corps have increased their efforts to quantify and justify environmental benefits analysis through the judicious use of complex ecological models. Unfortunately, when these evaluation tools are either unavailable, expensive, time consuming, and/or insufficient, planners have resorted to unstructured and undocumented professional judgment to fill the information gaps in the analyses.

But simply referencing "professional judgment" in a decision document has proven inadequate and unacceptable to internal and external reviews.

Reviewers and decision-makers alike are demanding a reassurance from the planning community that the information presented in their reports is truly the "best" available, that the individuals providing "judgment" are the professional experts in that area of expertise, and that the their "judgments" are sound.

Planners are now challenged to acknowledge and embrace uncertainty (Sear et al. 2008) while employing professional judgment in a more formal manner that strengthens rather than weakens the process. This approach requires comprehensive, highly detailed documentation of expert elicitation and the subsequent assumptions inherent to the use of this expert-derived knowledge (Meyer and Booker 2001). Documentation ensures transparency, fosters open communications with stakeholders, and engages formal review as an oversight mechanism. Success ultimately hinges on the veracity of the participant's expertise. The key then is to gather the "best" available experts and extract the information from them with as little bias as possible.

Inevitably, planners will ask this question . . . . "When do we deploy these tools, and at what point do we move from these more qualitative approaches to more quantifiable approaches?"

To answer the question, we convened a workshop of experts (both from academia and resource agencies) on June 19-20, 2008 to brainstorm and formalize the "state-of-the-practice" surrounding the use of professional judgment to date, discussing both the pros/cons of its application.

Participants were selected based on their interdisciplinary knowledge and on-the-job training, their wide array of system specialties (e.g. streams v. wetlands v. coastal), and their broad experience in technical applications.

An informal interactive group approach was used to elicit the expert's opinions. A series of questions were posed to the participants via PowerPoint slides, and all responses were recorded therein. Based on the responses, a series of protocols to both elicit professional judgment, and effectively and scientifically-defensible use professional judgment in ecosystem restoration planning activities were derived.

After the workshop, the participants were asked to contribute their knowledge and expertise to developing both a journal article on the "state-of-the-practice," as well as white paper that would serve as interim guidance in the prudent use and documentation of professional judgment in ecosystem restoration applications.

Once the workshop participants narrowed the topic, a literature review was undertaken to amass the "state-of-the-science" and to develop background information for the products.

Detailed minutes of the workshop proceedings (along with the final slideshow) are available upon request.

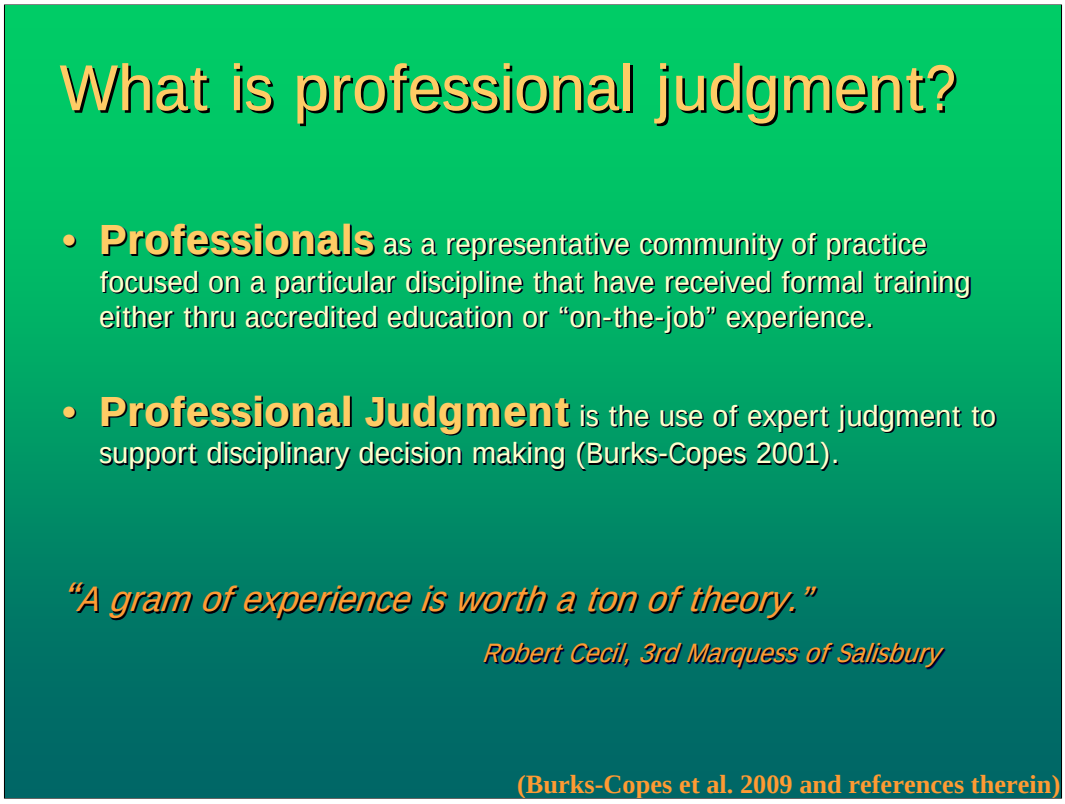
We all have an idea about what "professional judgment" is, but definitions vary across the community of practice. For our purposes, the workshop participants chose to define key terms in the following manner:

Judgment refers to inferences made in forming opinions (Daneshkhah 2004).

Experts are defined as experienced persons with special knowledge or skills in a particular domain (Meyer and Booker 2001).

Expert Judgment is the inferential opinion of a domain specialist regarding an issue within his/her area of expertise (Daneshkhah 2004).

Expert Elicitation is the process of gathering the expert judgment through specially designed methods or verbal or written communication (Meyer and Booker 2001).



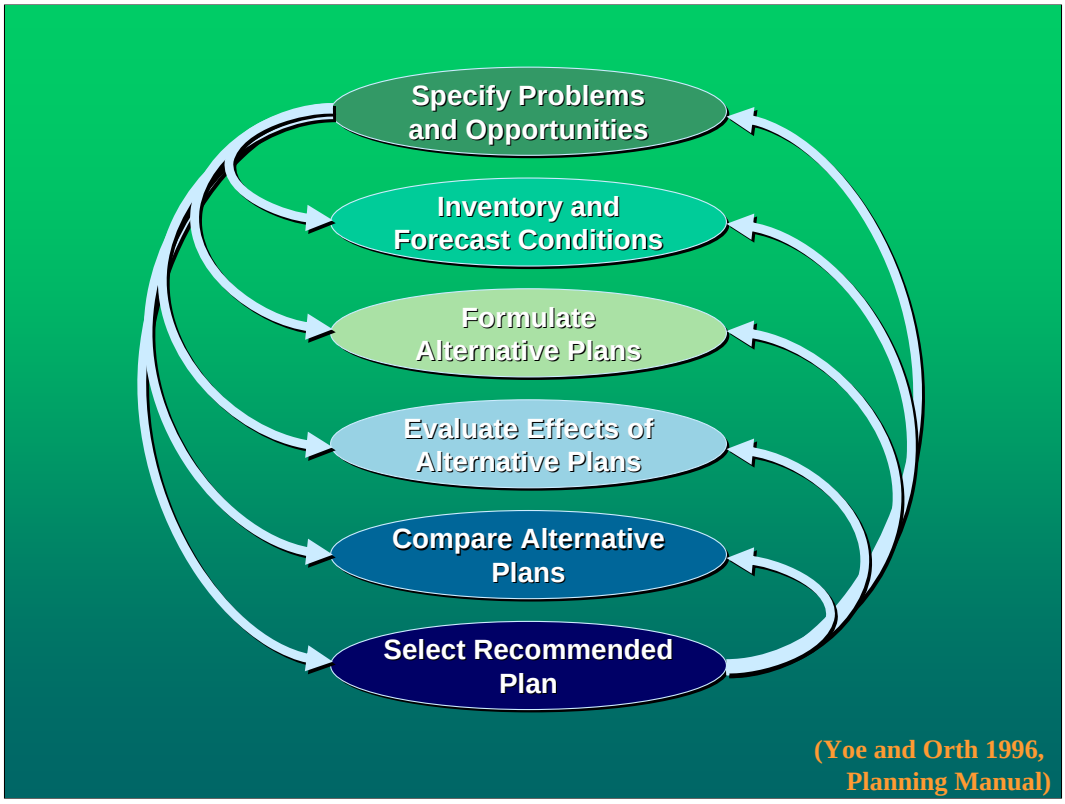
Professionals as a representative community of practice focused on a particular discipline that have received formal training either thru accredited education or "on-the-job" experience (Burks-Copes 2001).

Professional Judgment is the use of expert judgment to support disciplinary decision making (Burks-Copes 2001).

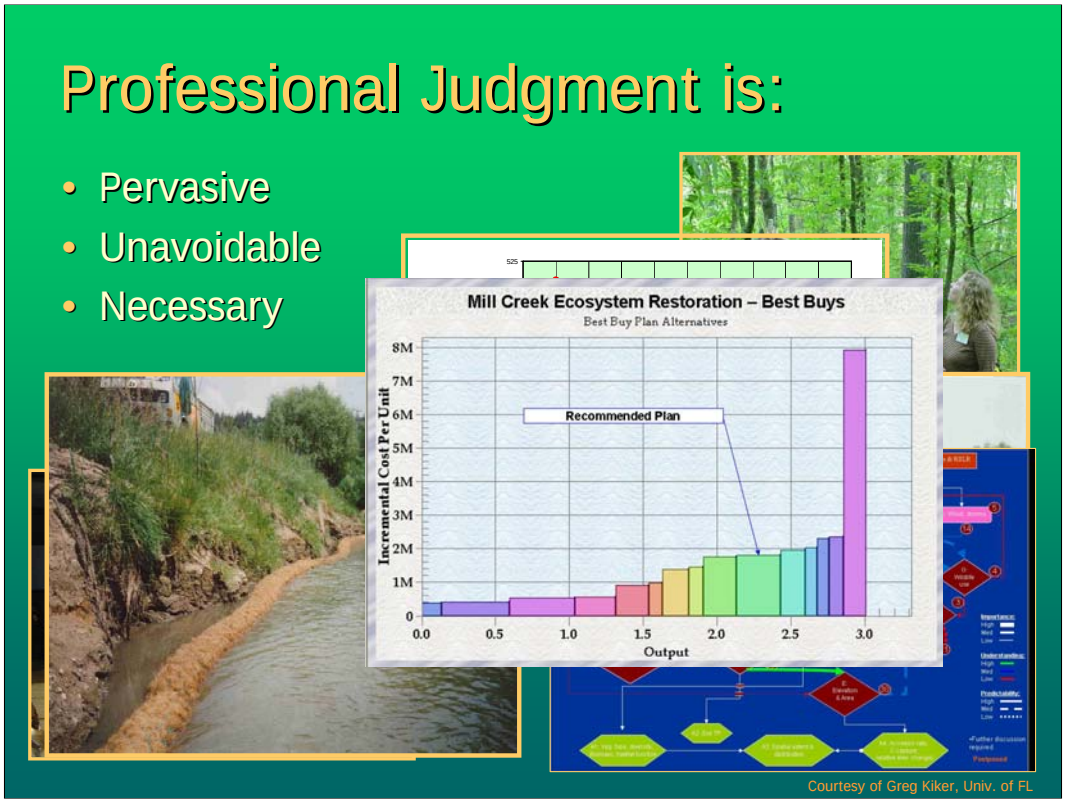
Not all professionals are experts.

For example, I consider myself an expert in Habitat Evaluation Procedures (HEP) and have been applying HEP and developing models for the Corps to conduct environmental benefits analysis in both the flood risk management and ecosystem restoration arenas for more than 15 years. But when I'm brought in to assist in the planning efforts for these studies, I do not consider my self an expert in the ecosystem of concern. If I'm asked to build a riparian cottonwood model for a HEP application, I empanel a group of riparian zone experts to parameterize the model. I don't develop the sampling protocols to measure the baseline conditions of the study area myself, but rather I use professionals AND experts to develop the sampling scheme. When I facilitate the forecasting and design meetings, I elicit the expert's opinions of the future conditions, for I am the professional knowledgeable in HEP, not in the study's drivers and stressors. I rely HEAVILY on experts to fill my knowledge base with useful information that as a professional I do not have.

But in our experience the field uses the terms **expert judgment** and **professional judgment** interchangeably, so for now we'll continue to call them both collectively "professional judgment."



Professional judgment permeates the Corps planning process. It is used to determine what we currently know, what we do not know, and what we feel is worth learning. After all, natural resource managers and decision makers are continually confronted with the consequences of unknowable, long-term, system-wide uncertainties that threaten ecosystem structure and function. Planners are therefore faced with the difficult task of evaluating the effectiveness of management decisions across temporal and spatial scales. These complex, often multi-agency efforts to maintain accountability for regional ecosystem integrity while tracking the loss or restoration of key services, structures, and functions, present a unique and challenging environment in which innovative approaches to ecosystem evaluation are essential to program success.

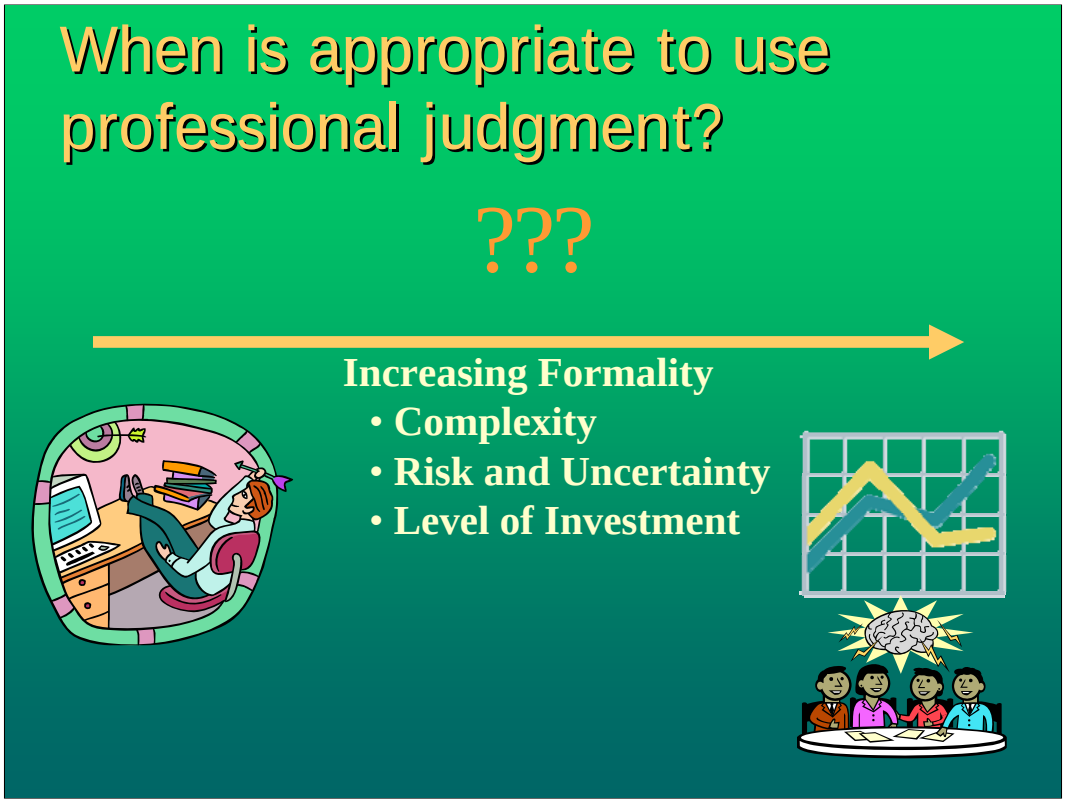


Throughout the process, professional judgment is encountered when:

- Building conceptual models – for example, defining drivers and stressors, highlighting their relationships to effects and determining endpoints
- Formulating problems, opportunities, constraints, goals, and objectives – all of which are subjective and cannot be quantified with any level of uncertainty
- Collecting, estimating and integrating data – from hiring a contractor to sample the area, to laying out transects (either randomly or systematically), to selecting and mapping the cover types at a site based on local classification schemes, to selecting statistical procedures to process the data
- Selecting and/or developing models – from choosing to use an off-the-shelf model or choosing to build one from scratch and subsequent testing and calibrating of the models in the field
- Formulating and forecasting the ecosystem response to alternatives – from the ad hoc designing of plans, to computer modeling and predicting future outcomes (possibly under urban sprawl or even global climate change) within multidisciplinary team
- Performing tradeoffs and selecting recommended plans, developing monitoring strategies and setting performance thresholds that trigger adaptive management

The point is, professional judgment is pervasive, unavoidable and we couldn't do our jobs without it.

However, there is a distinct difference between experts using their common sense within a planning effort to develop model inputs versus the blanket substitution of professional judgment when data, models and empirical evidence can be used instead. The latter is difficult to defend as "scientific" in any way.



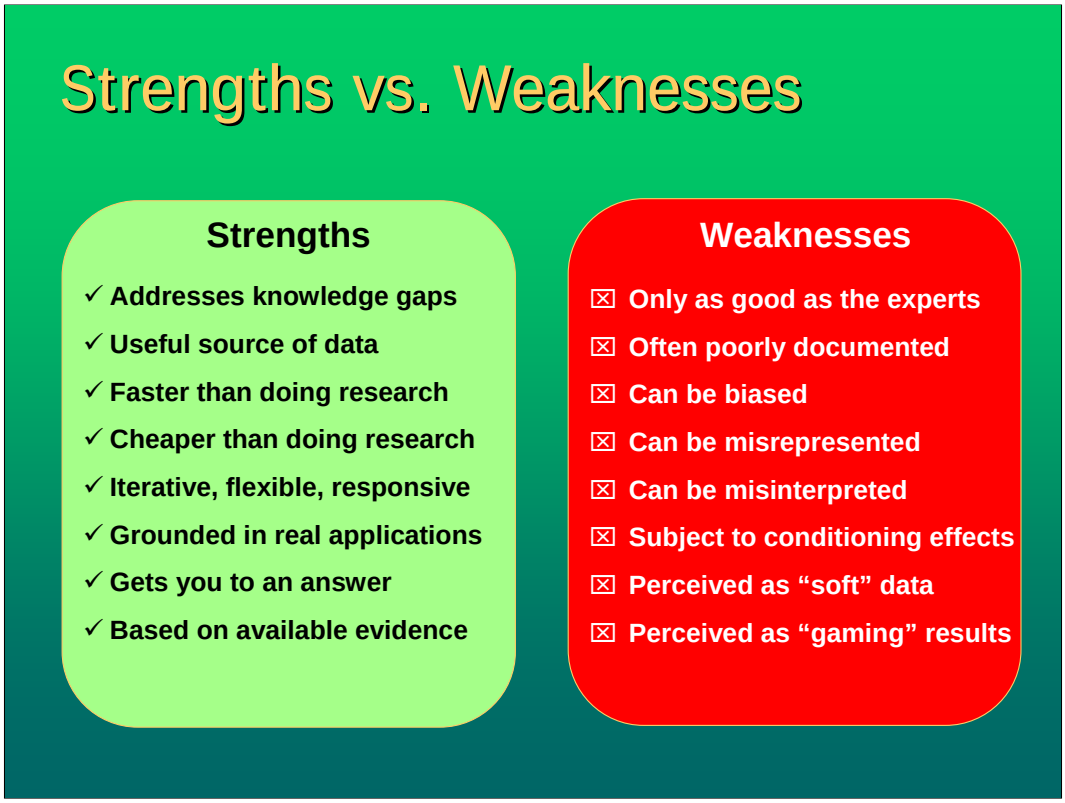
The most obvious question becomes when is it appropriate to use professional judgment?

At present, the Corps does not have guidance on when you can or can't use professional judgment in the planning process. We always deal with a level of effort commensurate with importance of the decision; but its use should also be balanced against what options are available. So it is important to avoid relying solely on professional judgment.

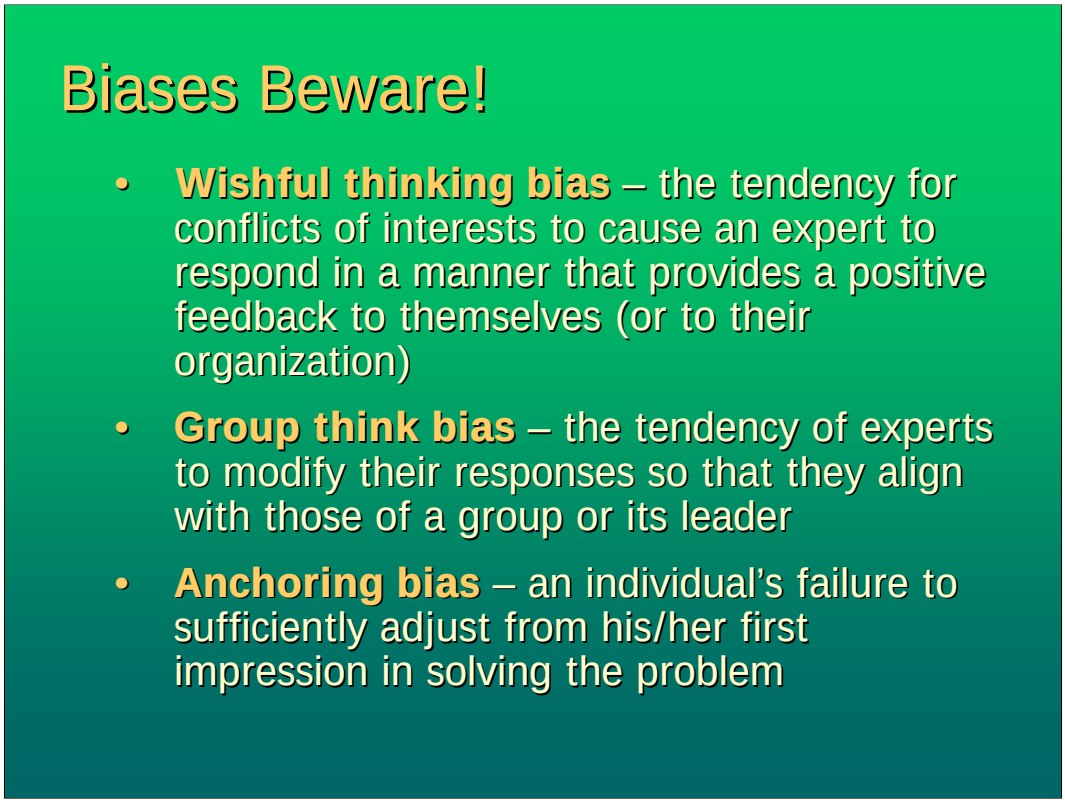
Generally speaking, the workshop participants assumed a study's complexity was correlated to the level of uncertainty anticipated and the subsequent risks tied to making the wrong decisions. As such, they assumed that an acceptable level of professional judgment could be dictated by the level of investment and therefore produced the following rule-of-thumb . . . . Increasing formality = less reliance on professional judgment.

Also, I think we can all agree that the Model Certification and Independent External Peer Review or IEPR processes are likely to direct PDT's early on to tools with higher degrees of rigor and less reliance on professional judgment. If you've met the requirements of model certification and IEPR, you're not likely to be relying solely on professional judgment.

Would anyone like to share their experiences with the group? Can you give us some examples of tipping points where your District has made the decision to move from using professional judgment to another methodology?



Recognizing that there are both pros and cons to the use of professional judgment.



Obviously, reliance on professional judgment is fraught with some strategic weaknesses, but these can be overcome with a little forethought, some awareness as to biases, and a little advanced preparation.

Several types of biases are of particular concern in Corps planning studies, and are defined as:

Wishful thinking bias – the tendency for conflicts of interests to cause an expert to respond in a manner that provides a positive feedback to themselves (or to their organization);

Group think bias – the tendency of experts to modify their responses so that they align with those of a group or its leader.

Anchoring bias – an individual's failure to sufficiently adjust from his/her first impression in solving the problem.

Bias can degrade the quality of the data and affects the credibility of the project's outcome. Regardless of whether or not bias is readily apparent, a study is open to criticism unless it addresses bias through experimental design.

So what is the solution?

"Expert judgment will always be a key ingredient of technical analysis."

Keeney and Winterfeldt (1989)

Harris County, Texas after Tropical Storm Allison (2001)
Clear Creek Flood Risk Management Study
Photo courtesy of the Galveston District

We must accept that some degree of professional judgment will permeate the process. In those instances, it is better that these judgments are made by experts who have the technical knowledge and expertise to corroborate their opinions. After all, according to Keeney and Winterfeldt:

"experts are sought to work on complex problems precisely because of their expertise, not because they are able to avoid the use of judgment" (1989).

Acknowledging then that the primary weaknesses of professional judgment stem from biases and perceptions, we can address the prudent use of professional judgment in the environmental benefits arena.

So what is the solution? Obviously, we cannot continue down the path we are on . . . .

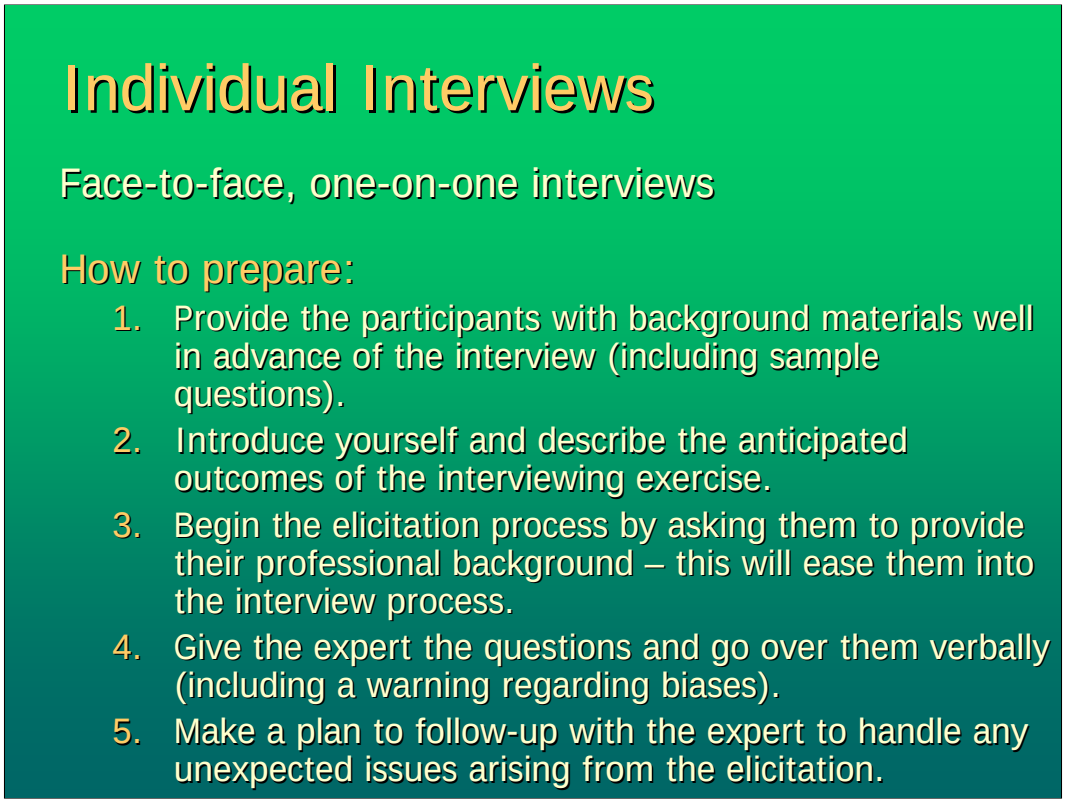
3 Basic Methods to Extract Professional Judgment

- Individual Interviews
- Delphi Panels
- Interactive Groups

To overcome the perception of “gaming” or ad hoc decision making, you might consider employing a more formalized approach to asking the expert’s or the professional’s their opinion.

Three basic techniques to consider include:

1) Individual Interviews,
2) Delphi Panels, and
3) Interactive Groups

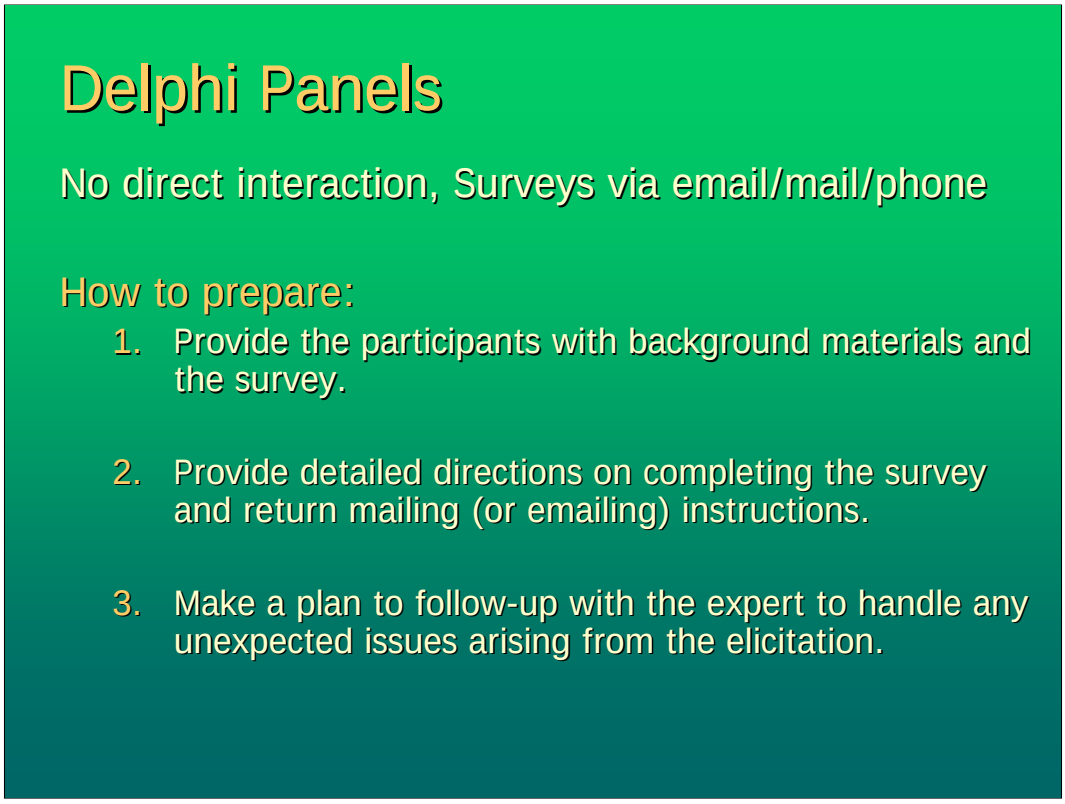


Individual Interviews

In this instance, a facilitator interviews the expert in a private, usually face-to-face, environment. This situation allows an interviewer to obtain in-depth data from the expert, such as how to solve a proposed problem, without having him/her distracted or influenced by other experts. This is also referred to as *Nominal Group Technique* when the experts' estimates are mathematically combined to form one *group* answer (Dunnette et al. 1963).

How to prepare:

1. Provide the participants with background materials well in advance of the interview (including sample questions).
2. Introduce yourself and describe the anticipated outcomes of the interviewing exercise.
3. Begin the elicitation process by asking them to provide their professional background – this will ease them into the interview process.
4. Give the expert the questions and go over them verbally (including a warning regarding biases).
5. Make a plan to follow-up with the expert to handle any unexpected issues arising from the elicitation.



The Delphi Approach

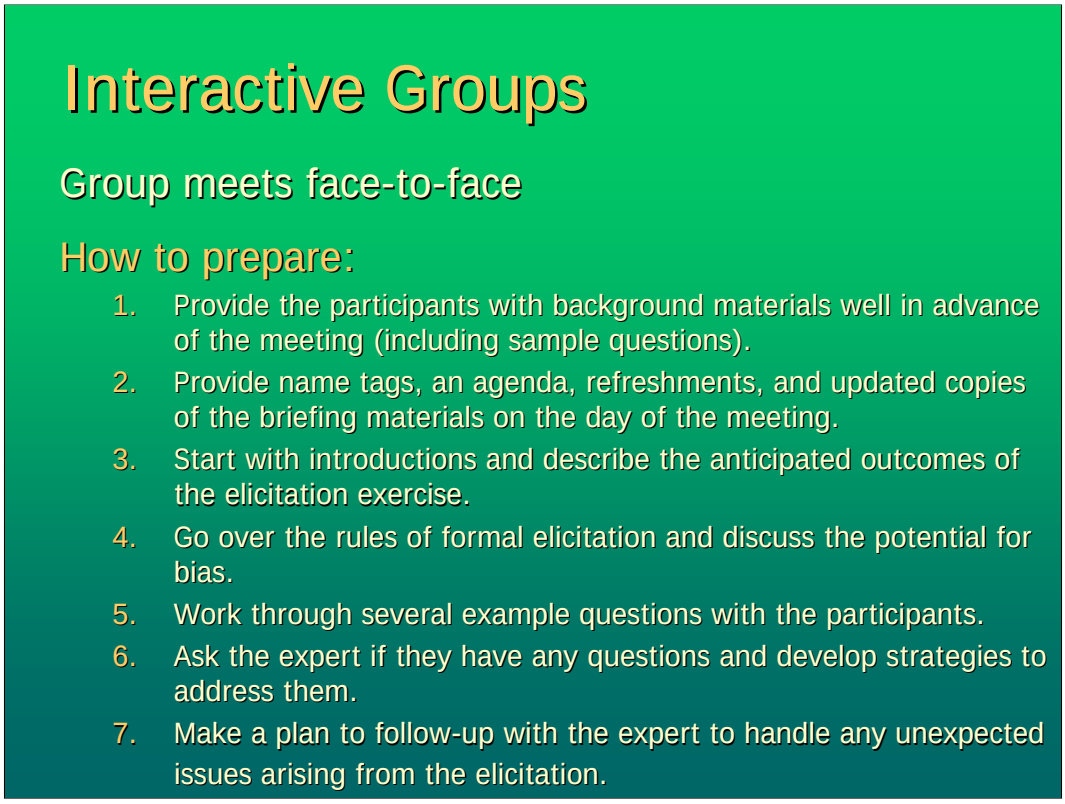
The *Delphi* approach is a technique developed by the Rand Corporation to limit the biasing effects of interaction (Linstone and Turnoff 1975). In a *true Delphi*, the experts do not interact with one another and only interact with the facilitator in a limited way. The experts, in isolation from one another, give their judgments and in some cases, their reasons for making these judgments. The facilitator collects these judgments, makes the judgments anonymous, distributes these judgments back out to the individual experts, and allows each of them to revise their previous judgments. This process can be repeated for as many times as desired (e.g., until consensus is achieved).

How to prepare:

1. Provide the participants with background materials and the survey.

2. Provide detailed directions on completing the survey and return mailing (or emailing) instructions.

3. Make a plan to follow-up with the expert to handle any unexpected issues arising from the elicitation.

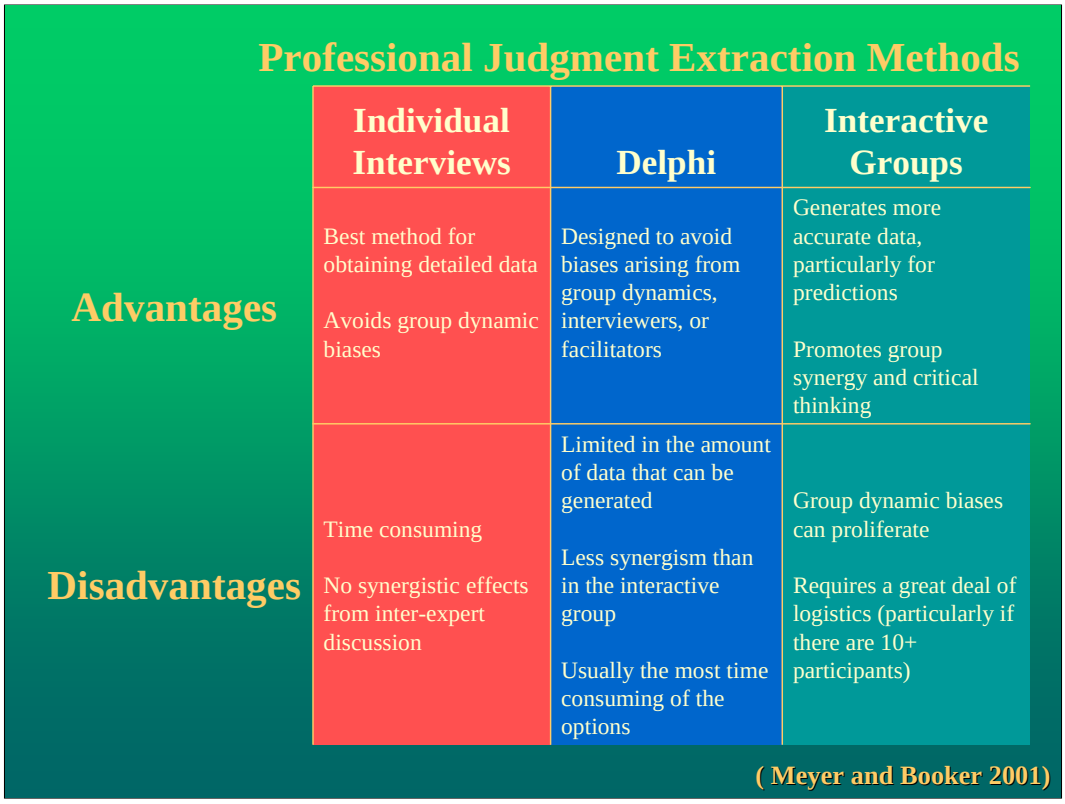


Interactive Groups

In this case, experts and a session facilitator meet in a face-to-face situation to give and discuss their data. The participants' interactions with one another can be structured as needed: (1) a totally unstructured group resembles a typical meeting, while (2) a highly structured group is carefully choreographed as to when the experts present their views and when there is open discussion; such procedures help to prevent some of the negative effects of interaction. More recent environmental decision making methodologies focused on collaborative learning (Daniels and Walker 2001 and many others) promote group learning and discovery as a systematic and iterative process. This approach relies on "systems thinking and learning" using a variety of stakeholders rather than single event that elicits experts with subsequent one-way communication to stakeholder groups.

How to prepare:

1. Provide the participants with background materials well in advance of the meeting (including sample questions).
2. Provide name tags, an agenda, refreshments, and updated copies of the briefing materials on the day of the meeting.
3. Start with introductions and describe the anticipated outcomes of the elicitation exercise.
4. Go over the rules of formal elicitation and discuss the potential for bias.
5. Work through several example questions with the participants.
6. Ask the expert if they have any questions and develop strategies to address them.
7. Make a plan to follow-up with the expert to handle any unexpected issues arising from the elicitation.



But which technique is the right one to choose? Each technique has its obvious advantages and disadvantages. Here we offer a brief comparison of these issues in the hope that planners can use the information to justify a selection (Table 1).

Firm in Principles, Yet Flexible in Details

- Customizing these Approaches to Fit the Need
  - The degree of interaction between the experts
  - The amount of structure imposed on the process
  - The number of meetings
  - The time allotted to structure the problem and elicit the answers
  - Who performs these tasks (expert vs. analyst)
  - The response mode in which the expert estimates are elicited
  - Whether the expert's reasoning is requested or not
  - The level of detail presented
  - Whether the elicited information is transformed for model input
  - Whether all or some of the elicitations are conducted in person, by mail, or by telephone

Customizing these Approaches to Fit the Need

To be clear – we suggest a portfolio approach to elicitation where planners customize elicitation techniques to fit the way experts think rather than force experts to adapt to a particular methodology. To that end, the elicitation process can (and should) be customized to address:

- The degree of interaction between the experts
- The amount of structure imposed on the process
- The number of meetings
- The time allotted to structure the problem and elicit the answers
- Who performs these tasks (expert vs. analyst)
- The response mode in which the expert estimates are elicited
- Whether the expert's reasoning is requested or not
- The level of detail presented
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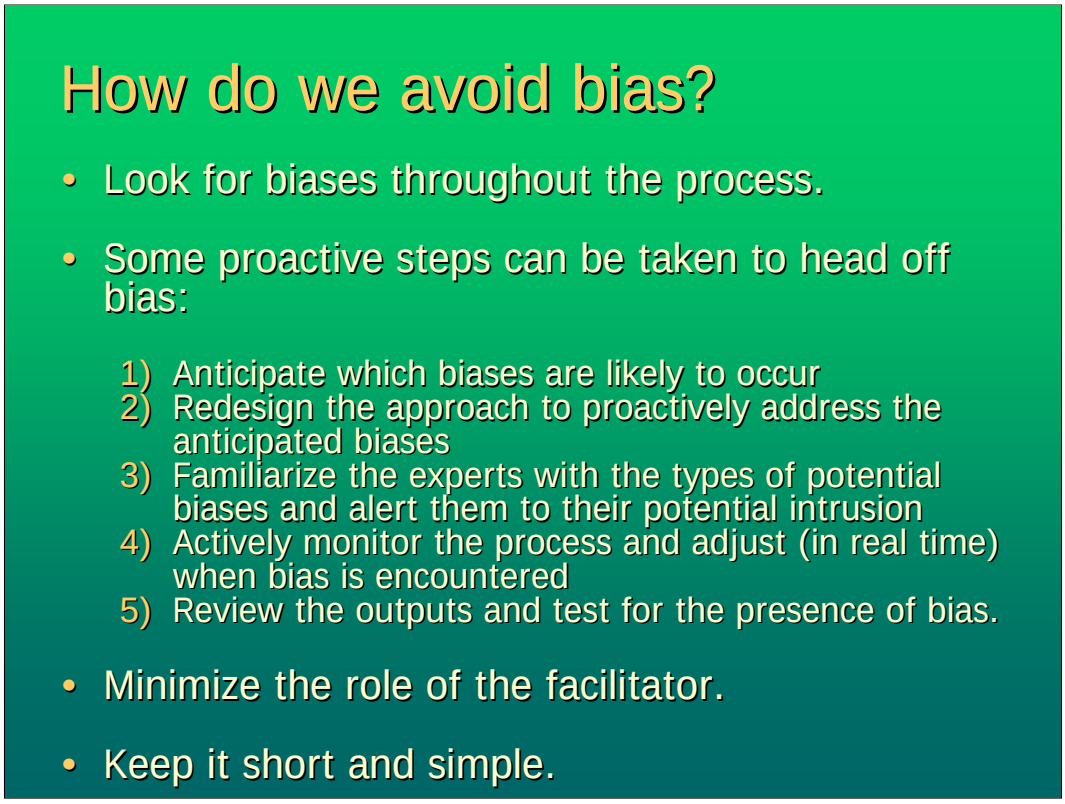
- Whether all or some of the elicitations are conducted in person, by mail, or by telephone



Regardless of the technique you choose, be sure to monitor, control and analyze biases throughout the process. The following proactive steps can be taken to head off bias:

1) Anticipate which biases are likely to occur – does your expert team lean towards a leader to follow (the loudest voice), do they tend to jump a decision early-on and refuse to re-evaluate the situation when new information comes online, or are there strong agency-driven agendas being played out in the process?
2) Redesign the approach to proactively address the anticipated biases – you can move toward an anonymous voting approach such as TurningPoint, Expert Choice, or even just simple hard copy ballots
3) Familiarize the experts with the types of potential biases and alert them to their potential intrusion – give them a little heads-up slideshow or read-aheads that describe potential biases and "signs" to watch out for.
4) Actively monitor the process and adjust (in real time) when bias is encountered – this requires a level of flexibility or even "re-setting" in other words, if biases is being encountered, take a break. Grab some coffee, pull people aside and talk to them individually, and brainstorm work-arounds.
5) Review the outputs and test for the presence of bias. If you remove the "alpha" expert's input, do you get a different answer? Objectively review the answers in light of potential agency bias. Did the answers begin to change when new information was injected into the process.

Early Warning Signs for Bias

Groups Think:

The room is very quiet and no one voices an opinion

Participants tend to defer to one or more members of the group

Wishful Thinking:

If the experts were previously judged to have something to gain from their answers

If experts answer quickly with very little thought given to the problem

Anchoring:

If an expert receives new information but never waivers from his/her first impression.

Reduce the potential influence of the facilitator by using a subject-matter neutral folks.

This proactive approach will reduce the opportunity for the facilitator to either misinterpret or misrepresent the expert's opinions.

Keep it short and simple. Do not create an elicitation that exceeds the expert's capacity to mentally juggle more than seven items at a time.

A Formal Process to Extract the Information

5 Basic Steps:

1. Define the topic of interest and the information that is needed from the experts
2. Select the experts
3. Select or Develop a formal approach to elicit the information
4. Practice to improve proficiency and strategize response mechanisms, and finally
5. Elicit and document the process and the results.

Upper Des Plaines River Phase II Feasibility Study
(Chicago District)
Kelly A. Burks-Copes

Once we determine that professional judgment is warranted, we must focus on the quality of information extracted from the experts.

To this, we follow 5 basic steps:

1. Define the topic of interest and the information that is needed from the experts – are you looking to define problems and opportunities, define a study area boundary, forecast future conditions, develop a model, what exactly do you their input on?
2. Select the experts
3. Select or Develop a formal approach to elicit the information
4. Practice to improve proficiency and strategize response mechanisms, and finally
5. Elicit and document the process and the results.

Step 1-Defining the Topic of Interest

To begin, you must first identify the topic of interest and the information that is needed from the experts. Remember, we're focused here on the entire planning process here – in other words every point where you're likely to encounter a need to use professional judgment, and developing strategic ways to facilitate the process in a scientifically-defensible manner. So you must decide whether your trying to use it to:

Set goals and objectives

Draw the project boundary

Develop metrics

Select or build a model

Develop sampling protocols

Select approach and perform data analyses

Forecast the future

Formulate alternatives and their response

Perform tradeoffs – possible with techniques such as multi-criteria decision analysis

Set performance criteria or thresholds

Develop triggers for adaptive management

Determine how to quantify uncertainty and to what extent

And then determining the level of risk

Step 1 - Defining the Topic of Interest

3 Common Issues to be aware of:

1. There are limits to the amount of information experts can process at one time (magic # is 7).
2. The level of detail presented can skew the results.
3. Facilitators and experts alike can introduce bias.

There are three common issues encountered regularly in the designation of the focus and the elicitation of expert opinions:

There are limits to the amount of information experts can process at one time. The human mind has limited memory for information processing. Miller (1956) noted, most individuals cannot discriminate between more than seven things at one time. So, if you're asking a group of experts to forecast the future conditions, they will only be able to work with a few key inputs . . . We've learned to group our questions by categories and in a specific order. First we ask, what is the water doing, and we focus on all water-related issues at that time. Next we ask, given your answers to the water forecasts, how will the vegetative respond? Then we pull back, and ask questions at the landscape scale . . . . Given these changes in water and vegetation, what does this do to patch dynamics. We keep all of the information up on the screen and provide hard copies that the experts can fill in themselves to keep up with the process.

The level of detail presented can skew the results. The level of detail at which the data is gathered, processed, and interpreted establishes the framework for the restoration study's evaluations. When addressing complex problems, experts tend to rely on heuristics (i.e., rules-of-thumb) to simplify the issues and form opinions. Familiarize yourself with the expert's heuristics, utilize them to the greatest extent practicable, but be cognizant of their affect when incorporating the results into an analysis of environmental benefits. For example, we provide hard copies of the project summary and maps showing the locations of particular hot spots to facilitate goals and objectives formulation as well as alternative formulation. If an expert has a question regarding a particular input, we've been known to stop and get the information from the net or from conference calls to other experts.

Facilitators and experts alike can introduce bias. Bias can occur when an expert's opinion is not voiced accurately, when their estimates do not follow logical rules, or when their responses are either misinterpreted or misrepresented.

"Thank you Joe Nobody for giving me your expert opinion on what a missile sounds like, because gas station superintendents are usually the best people to ask about the sonic signature of ballistic missile thrust."

George Ouzounian
(aka Maddox)

So how do you put together a good expert team and how many experts are needed to reasonably address the problems at hand? There will always be critics who question the veracity of the expert team's capabilities, but planners can proactively employ strategies to counter these criticisms.

Proactively Seek Out Diverse Prospects

First, develop a transparent, systematic approach to selecting the experts. This approach can take many forms. Planners can look in-house to locate potential prospects, but they should also look to the natural resource agencies, academia, and the peer-reviewed literature to supplement the expert pool. Word-of-mouth can generate a list of potential prospects as well. Talk to other planners in your District to find out who they have used in the past. Talk to potential prospects themselves, and ask for their suggestions. The selection of experts who are well known and respected among their peers and the broader scientific community (not to mention the public arena) can lend the project greater credibility (Meyer and Booker 2001). Although this rather informal approach seems arbitrary, the goal is to generate a robust list of potential participants to screen from.

Screen the Prospects

The next step is to screen these prospects. Here we suggest developing a list of goals and objectives to facilitate the process. A good rule of thumb is to select a diverse group of experts to assure consideration of the study's problems from various view points. A proliferation of diverse opinions can often overcome the tendency to anchor to one, conservative, reference point (Meyer and Booker 2001). This diversity can be achieved by mixing yet balancing disciplines, affiliations, and/or level of expertise. Here we offer an initial list of criteria to begin the process.

In our experience, it is helpful if experts:

- Can demonstrate a rich topical knowledge obtained either through extensive field experiences or academic pursuits,
- Yet are somewhat independent of the outcome – particularly in light of the National Academy of Science protocols on conflicts of interests and potential for biases,
- Are cognizant of the Corps planning process,
- Are well versed in environmental benefits analysis,
- Are skillful problem solvers
- Are willing to prepare for and engage in the study's assessment activities, and
- Have good communication skills and a desire to inject their knowledge and experiences into the elicitation process.

Some of this information can be garnered as the experts participate in the process (i.e., knowledge of the Corps planning process or particular benefit derivations), but selecting well-versed experts can move the process along more quickly.

How many is enough?

On a more technical note, the exact number of experts to include can vary according to the complexity of the planning effort. For example, if onsite meetings are called for, we recommend having 5 to 10 experts in a session. Fewer than 5 experts can reduce the chance of providing adequate diversity or information to make inferences. Ten experts in a session is usually the maximum for obtaining in-depth thinking from each expert yet having enough control to counter potential effects that can arise from group dynamics (e.g., Group Think Bias).

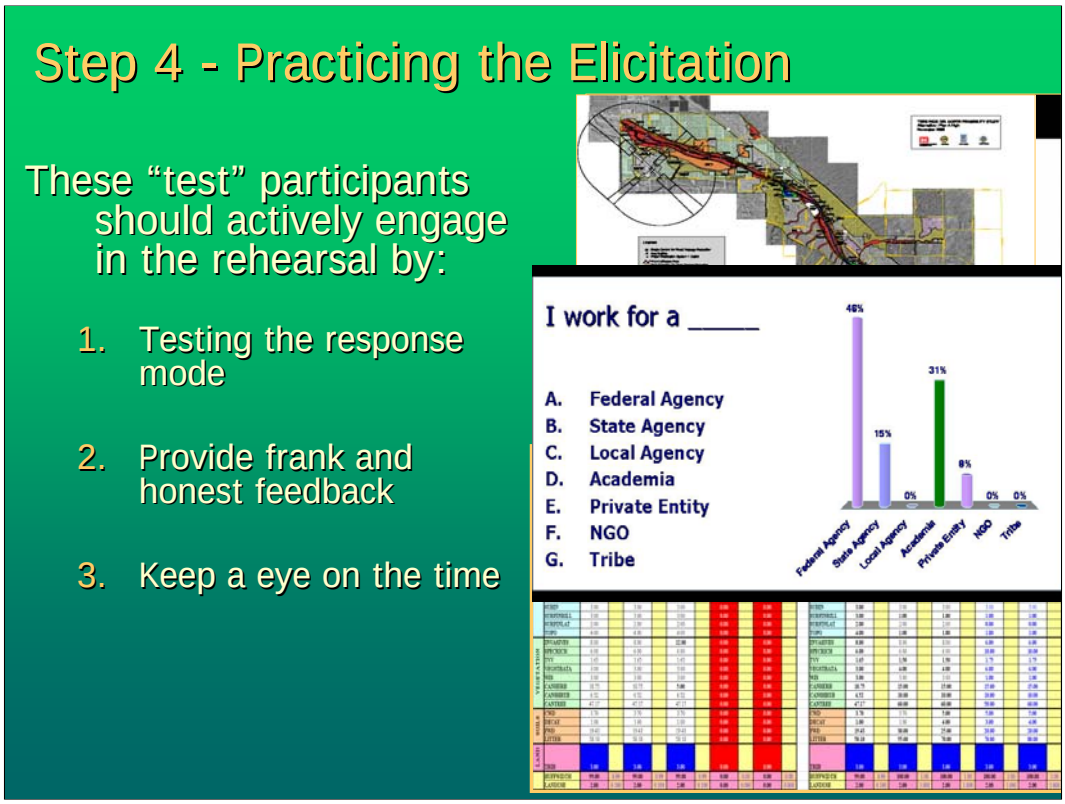
Step 3 & 4 – Select an Approach and Practice

- Choose between Individual, Delphi, Group or some combination thereof . . .
- Then practice – include in the rehearsal:
  1. An introduction of the process itself including sample questions and a briefing on bias
  2. A description of the elicitation procedures and a description of the documentation that will result from the exercise
  3. A discussion of how the expert's answers will be incorporated into the environmental benefits analysis (including a discussion of aggregation with other expert's answers).

You'll need to choose an approach and then practice. We realize that few planners have formerly undergone training in these methods. The Environmental Laboratory here at ERDC has several teams with extensive training and experience using these approaches. Or, you could give the PCX a call and they could help you find a private firm to assist you.

However, if you decide to do this on your own, and because you may not be comfortable or fluent in the art of formally eliciting information in a group setting, we strongly suggest staging a trial run (using in-house staff and any readily available experts that are willing to serve as "guinea pigs") to test the planner's proficiency in elicitation, develop work-around strategies to handle problems, and provide an estimate of the amount of time it will take to extract the required information. The following items should be included in the rehearsal:

1. An introduction of the process itself including sample questions and a briefing on bias.
2. A description of the elicitation procedures and a description of the documentation that will result from the exercise. These can be provided in read-aheads along with sample questions. A summary of their roles and expectations should be made up front.
3. A discussion of how the expert's answers will be incorporated into the environmental benefits analysis (including a discussion of aggregation with other expert's answers). Make sure to recognize the value of their contributions to the decision making process.



These "test" participants should actively engage in the rehearsal by:

1. Testing the response mode (work through a problem using the survey forms, spreadsheets, or any software applications that capture their responses).

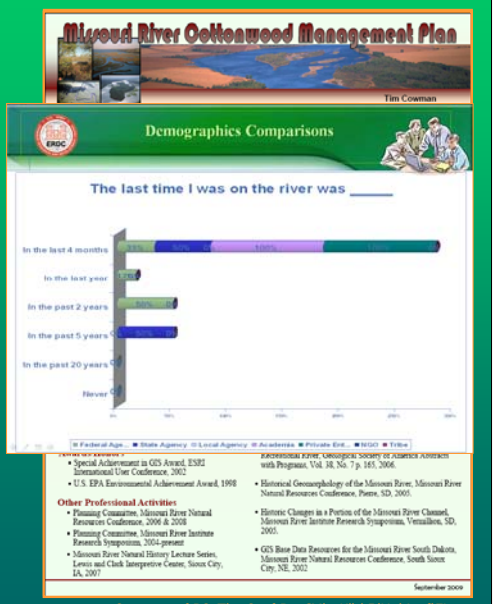
   As an aside . . . . There are automated expert elicitation software packages on the market today. We've been using something called TurningPoint which is a MS PowerPoint compatible package that records expert responses on-the-fly. But to make the elicitation process seem seamless, we spend a great deal of time upfront (several weeks) building the interfaces (the questions to be asked, the format in which they are presented, the documentation protocols both during and after the fact) and testing them on consumer groups (i.e., our in-house staff and some of experts here at the laboratories). We have even recently made it a point to "test" these response modes in Live Meeting settings before we host the elicitation to familiarize the expert team with the environment to smooth out the process.

2. They need to provide you with frank and honest feedback on the introduction of the process, the description of the procedures and documentation, and the discussion of the end products (#1 through #3 above).

3. You should pay particular attention to the times engaged in each step of the process and let the facilitator know if the process feels rushed or sluggish.

Step 5 - Defend the Process with Transparent Documentation

1. A description of the topic of interest
2. A list of the experts, their resumes and the screening procedures used to select them
3. A narrative describing the expert elicitation method
4. Documentation of the experts' responses



Courtesy of Dr. Tim Cowman, Adjunct Professor, [illegible]

The key to prudent use of professional judgment in environmental benefits analysis is the development of comprehensive, highly detailed documentation. The following topics should be addressed in the study's documentation:

1) A description of the topics addressed and any background information that clarifies the situation (e.g. definitions or assumptions that the experts made).

2) A list of the experts and their resumes (including their professional backgrounds, how long the have worked in the area of expertise, and their educational backgrounds). In our experience, we have found that that expert selection schemes are frequently criticized because their representatives are not all inclusive, and therefore do not necessarily capture the entire community of practice. Our response is documentation. Extensively document the selection scheme as a means of explaining and defending the process and the expert team's makeup. We suggest you include the:

- Selection criteria,
- Reasoning behind its use
- Number of experts who were invited to participate versus those who actually participated

Be sure to include resumes or curriculum vitae to demonstrate the expert's capabilities and knowledgebase.

3) A narrative describing the expert elicitation method used and how it was applied as well as an explanation for the selection of the method itself. Support for this section can include references from the literature and other considerations such as the project's data gathering objectives and the need to reduce costs and time. This section should also contain a frank description of any biases encountered and a discussion of the techniques used to alleviate these problems. Include here a discussion of how the methods were pilot tested or rehearsed and revised. Be sure to include an indication that the expert's judgments represent the current state of knowledge at the time of elicitation. Acknowledge uncertainties here as well. For example, it may be necessary to state that the data elicited might, with time and new knowledge acquisition, be subject to change.

4) And finally, the documentation of the experts' responses. At the minimum, summarize the expert's answers and provide a few sentences or paragraphs on their justifications at the time of the elicitation. Electronic copies (or hard copies) of any written surveys should be made available (upon request if necessary).

As an example, we've used TurningPoint software to breakdown the answers on the basis of agency affiliation or as in the case shown here, the last time the expert's visited the area – implying "on-the-ground" real-time knowledge of the study area. On the low tech end, we've simply used blank spaces in excel spreadsheets to document the group's decisions.

The Challenge

1. Start early and make time to do it right
2. Gather the "best" available experts
3. Extract the information without bias
4. Produce better documentation
5. Get smart about "Expert Elicitation"

Hurricane Katrina, 2005
Magee, MS - Beth Copes

Hurricane Katrina, 2005
http://www.katrina.noaa.gov/satellite/images/katrina-08-29-2005-1415z2.jpg

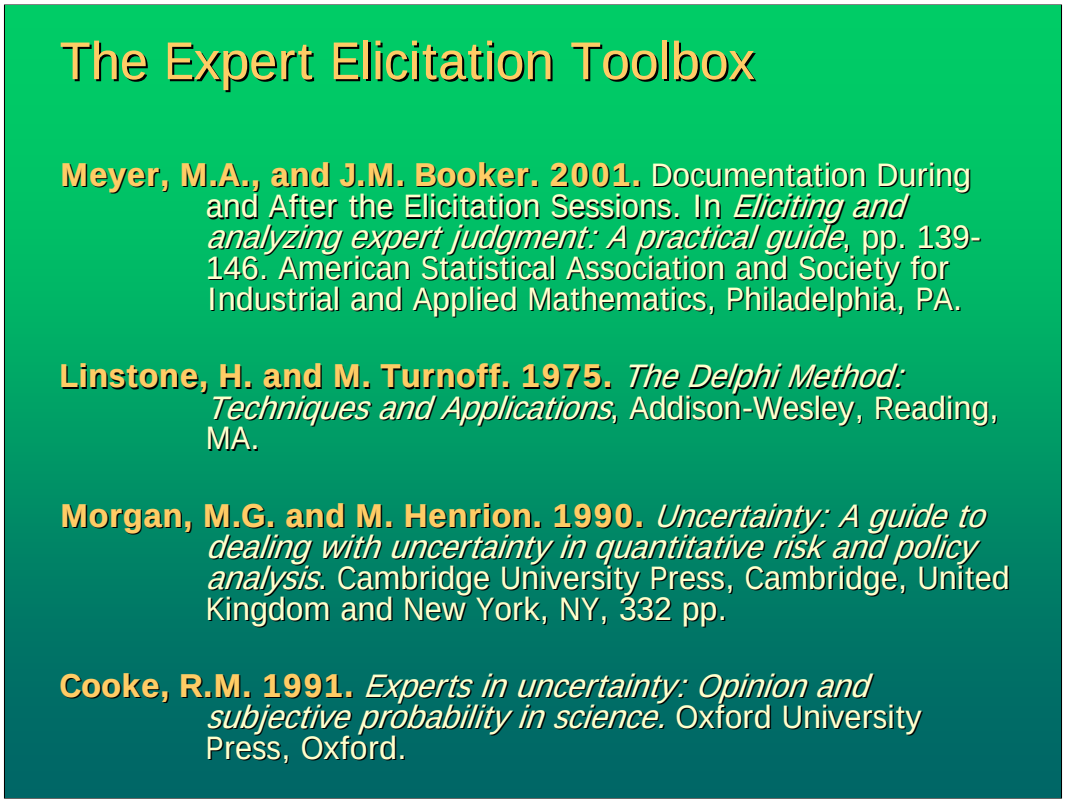
1. Start early in the process: Crisis management is not a primary strength of any activity, and a particular weakness of professional judgment according to Kynn (2008). The key to success is transparency. So we suggest you start early in the process and take the time to elicit the information in a professional, well-thought out manner.

2. Employ a well-balanced team: Multi-disciplinary teams often allow more perspectives to be swept into the judgment process. Social scientists are not often included in ecological expert teams, yet provide an essential role in providing information concerning the human/ecosystem interface. Expert teams should include a variety of institutions and levels of understanding to capture meaningful temporal and scale issues. And to the extent possible, these folks should be independent of conflicts of interests – in other words, have no stake in the outcomes.

3. Proactively address biases by monitoring, controlling and analyzing the effects on your outcomes. Watch for the early warning signs, and be flexible enough to adapt your approach.

4. Document everything: The objective of comprehensive documentation is to provide systematic information to verify that decisions are both structured and defensible to external peer review. Given the often iterative nature of ecosystem restoration planning and adaptive management, the ability to reproduce fundamental aspects of decisions and the information upon which they are based is a critical part of the institutional learning process.

5. Get smart about "Expert Elicitation": There is a sizable literature on expert elicitation in both theory and practice. Both experts and facilitators must be cognizant of the current literature and the primary issues concerning bias and probability. Adaptive methods for avoiding and mitigating cognizance and motivational biases within elicitation exist. Specific, practical guidance is provided in Meyer and Booker (2001) along with Morgan and Henrion (1990).



Because the supporting literature for expert elicitation is rich and varied, the review thus far has been by no means comprehensive. We suggest the following texts are essential "reads" for any planner's toolbox:

Meyer, M.A., and J.M. Booker. 2001. Documentation During and After the Elicitation Sessions. In *Eliciting and analyzing expert judgment: A practical guide*, pp. 139-146. American Statistical Association and Society for Industrial and Applied Mathematics, Philadelphia, PA.

Linstone, H. and M. Turnoff. 1975. *The Delphi Method: Techniques and Applications*, Addison-Wesley, Reading, MA.

Morgan, M.G. and M. Henrion. 1990. *Uncertainty: A guide to dealing with uncertainty in quantitative risk and policy analysis*. Cambridge University Press, Cambridge, United Kingdom and New York, NY, 332 pp.

Cooke, R.M. 1991. *Experts in uncertainty: Opinion and subjective probability in science*. Oxford University Press, Oxford.

State of the Science and State of the Practice

- **A technical note that can be referenced as:**

  Burks-Copes, K. A., L. A. Rabbe, G. A. Kiker, R. Muñoz-Carpena, M. D. Eberle, L. L. Skaggs, A. A. Sowers, J. K. Staebell, S. Traxler, A. C. Webb, and C. Yoe. 2009. **Addressing Risk and Uncertainty in Ecological Restoration Projects.** EMRRP Technical Notes Collection, ERDC TN EMRRP-XX-x, U.S. Army Engineer Research and Development Center, Vicksburg, MS. http://el.erdc.usace.army.mil/emrrp/emrrp.html

- **A journal article that can be referenced as:**

  Burks-Copes, K.A., G.A. Kiker, R. Munoz-Carpena, M.D. Eberle, L.A. Rabbe, L.L. Skaggs, A.A. Sowers, J.K. Staebell, S. Traxler, A.C. Webb and C. Yoe. In Press. **The use of professional judgment concepts within ecological restoration: Historical lessons and future directions for environmental benefits analysis.** *Ecological Restoration*

In addition to this webinar, two written products have been developed. The first is a technical note – a sort of users guide to the field describing the outcomes of the workshop and most of what has been presented here in this presentation. Currently this report is being externally reviewed, but when complete it will be available at the website provided here.

The second product is a peer reviewed journal article focused on characterizing the "state-of-the-science" in applied professional judgment and expert elicitation. The target journal for this effort is *Ecological Restoration* and we hope to see it in print later this year.

And if there is any interest, we've been thinking about follow-on webinars on this topic – perhaps focusing on the individual methodologies and discussing their use in particular studies across the country. So basically, we're soliciting ideas for the follow-on webinars – just pick up the phone and give us a call.

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And with that, we'd like to open the floor to questions and discussion. . . . .

Does anyone have any stories to share?

Where have you employed it?

How did it work?

What would you have done differently given unlimited resources (time, budgets, personnel)?