A SYNOPSIS OF IMMEDIATE AND DELIBERATE ENVIRONMENTAL ASSESSMENTS

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Abstract: Environmental assessments can be classified by the urgency of the problem and therefore the amount of time allowed for the assessment before a decision is made to benefit environmental and social objectives. Deliberate (occurring in an unhurried fashion) and immediate (performed without delay) assessments have different constraints; and different value judgments or standards are used to judge their quality. Being aware of the differences and similarities can improve the quality of both deliberate and immediate environmental assessments. In particular, deliberate assessments can eventually provide knowledge or decision tools for future unanticipated emergencies.

1. Introduction

Why do some environmental assessments result in better outcomes than others? One reason is that some have a clear framework to organize planning, analysis, synthesis, and decision-making [2, 10]. Another is that circumstances place different constraints on time and resources [7]. The intention of this paper is to suggest a convenient way to organize any assessment [2] and to draw attention to the time and resource constraints by comparing the similarities and differences between immediate and deliberate assessments. The comparison itself is built upon a framework that fully integrates all types of environmental assessments and provides a clear framework to ensure good organization so that deliberate and immediate types of assessments will effectively inform decision making and achieve environmental and social objectives.

I. Linkov et al. (eds.), Real-Time and Deliberative Decision Making.

2. Framework of Environmental Assessments

Environmental assessment is the process of providing scientific information to inform decisions to manage the environment [2]. They can be classified into four general types (Figure 1):

1. Condition assessments to detect chemical, physical and biological impairments
2. Causal pathway assessments to determine causes and identify their sources
3. Predictive assessments to estimate environmental, economic, and societal risks and benefits associated with different possible management actions [11]
4. Outcome assessments to evaluate the results of the decisions made using condition, causal, and predictive assessments [2]

The linkage between assessments is based on intermediate decisions that initiate another assessment or a final decision leading to the resolution of

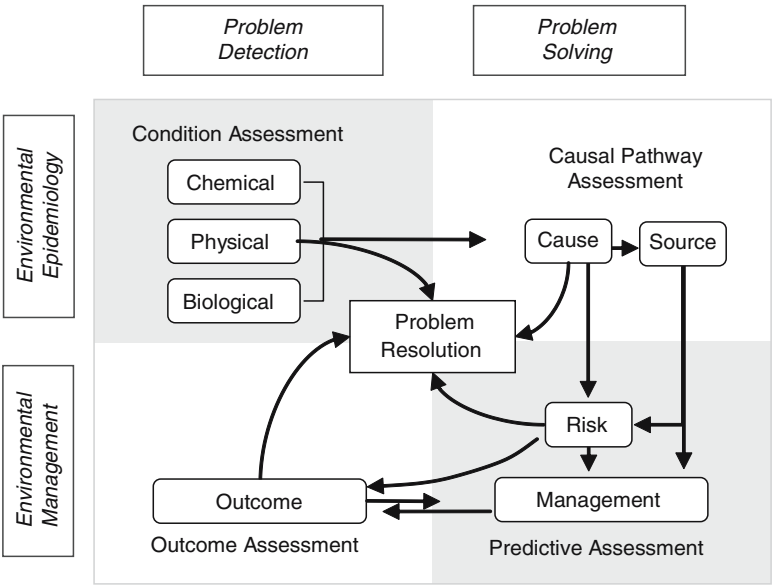

Figure 1. Flow of types (quadrants) and sub-types (oblongs) of assessments. Environmental Assessments evaluate the condition, causal pathway, prediction, and outcomes associated with problem solving or management. In general, deliberate assessments are more likely to address all of these types of assessments. Immediate assessments are more likely be a response to known causes and therefore condition and causal assessments are apt to be cursory and most of the effort focuses on risk and management options (lower two sectors) [2].

the problem [6]. By using a common structure of planning, analysis, and synthesis when describing activities within an assessment, the terminology is simplified and communication is facilitated between types of assessments and environmental programs.

Assessments can be further classified by the urgency of the problem and, therefore, the amount of time allowed before a decision is made to benefit environmental and social objectives. Although a dichotomous classification is used here, the distinction between deliberate and immediate assessments represents the extremes of a continuum of circumstances.

The differences between immediate and deliberate decision analysis are apparent from the onset of an assessment through the final decision and implementation. The differences begin with initial recognition of the nature of the problem to be addressed and they also affect the risk assessment, actions taken, and post-decision analysis of the process, including evaluation of the effectiveness of the decisions. The measures of success provide data to analyze approaches used and promote continual improvement of the process.

3. Types of Deliberate and Immediate Assessments

Deliberate assessments are undertaken when there is a long-term social commitment for implementation. For example, the goal of a deliberate assessment might involve the restoration of a river to its free-flowing condition, thus improving water quality and fish migration [12].

Immediate assessments are performed when there is imminent danger of irreversible and dire consequences, such as might occur prior to or in the aftermath of a hurricane or dam failure. Immediate assessments are sometimes called for when some action is planned that could have irreversible consequences; for example, a decision to permit mining near Yellowstone National Park [5] or to build roads into the habitat of the rare rhinoceros of Borneo [8]. Immediate data collection could be required if an ongoing effect such as an epidemic, or fish or bird kill, needs to be documented or its cause determined.

Deliberate assessments are more likely to involve long-term stakeholder interactions, data collection, uncertainty analysis, iterations, peer review, legal challenges, interventions, and reassessment. Deliberate assessments take more time, but when well planned combine all the types of assessments; that is: condition, causal pathway, predictive management, and outcome types.

Immediate assessments are more likely to depend upon past assessments, emergency action plans, scenario training, or access to experienced assessors and crisis decision analysts. They are constrained by time-critical decision points. Although the assessor and decision analysts may be cognizant of the

contribution of all the types of assessments, they may be forced to bypass some assessments or take advantage of emergency action plans that attempt to provide for these needs in advance.

3.1. CONDITION ASSESSMENT

Deliberate condition assessments are performed to determine whether there is a problem and establish baselines prior to actions. They may be based on previous risk assessments or criteria; for example, comparing water quality to ambient water quality standards for metals [3] or comparing observed populations to expected assemblages [4].

Immediate condition assessment may simply document rather than assess if the condition is obviously impaired, for example, observing many beached whales. If the crisis is anticipated, baseline data may be collected for later evaluation of outcomes. If the crisis is ongoing, the condition assessment may be bypassed or samples collected and stored for later evaluation, such as taking photographs and water, soil, or tissues samples. If the crisis is past, an immediate condition assessment usually can transition to a deliberate mode of operation. In an immediate condition assessment, attention is focused on potential areas to shield and document the extent of damage [1].

3.2. CAUSAL PATHWAY ASSESSMENT

Causal pathway assessments determine the probable causes of the environmental impairments revealed by condition assessments. They consider the proximate cause, the source, and the causal pathways that connect them [2, 16].

Deliberate assessment of causal pathways can be bypassed if the cause or source is obvious; for example, a broken effluent pipe emptying waste directly into a stream. However, most deliberate assessments of causal pathways are undertaken because the cause or source is unknown. This is especially true when the condition is an identified human health or biological impairment. In these situations, a causal assessment is needed so that the management action will address the right cause. Often there are multiple causes, and these can be dealt with in many ways [16]. However, they all include a comparison of several candidate causes to identify the most probable cause(s). When there are multiple sources, they need to be identified and the amount of the causal agent allocated among them. Immediate causal assessments may be uncertain due to lack of information; while the results of deliberate assessments may have greater uncertainty compared to situations encountered with immediate ones. For example, a decline in species in a stream may be due to unmeasured, episodic, chronically low levels of a stressor, while a massive fish kill may be associated with a strong

stressor such as an algal bloom or a chemical spill. An example of a deliberate causal pathway assessment is the investigation of bird kills associated with carbofuran poisonings [15].

Immediate causal pathway assessments may be bypassed if the cause and sources are obvious. When there are multiple causes or sources, the assessor identifies the most deleterious causes and sources. When the cause is unknown, exposure and effect data are collected, while the literature is searched for similar effects and potential causes. Action may need to be taken before a causal assessment is considered definitive. If the adaptive management is designed as an experiment, the attempts to manage the problem can be used to evaluate causes and sources even while management actions are underway. An example of an immediate causal pathway assessment is the investigation of an epidemic affecting humans, wildlife, or vegetation.

3.3. PREDICTIVE ASSESSMENTS

Predictive assessments estimate changes that will occur with different management actions, including the choice not to act. There are two main subtypes: risk and management assessments [11]. Risk assessments predict what will happen when a causal agent or source is altered in some way and how different management options will alter exposure to the causal agent or affect the source. Management assessments, often performed using decision analysis tools, evaluate the risk estimates in conjunction with economic, social, and political factors to predict the outcome of management actions with the intention of potentially meeting multiple goals.

3.3.1. Risk Assessment

Deliberate risk assessments may be applied locally or broadly; for example, an estimation of risks may be used to develop water quality criteria for metal toxicity to be applied nationally [13, 18]. On a local scale, a risk estimate may show that the metals are not bioavailable at that concentration, and site-specific criteria might be applied. The scope of deliberate risk assessments, because they have more time for analysis and implementation, may include a broader array of effect endpoints for consideration in addition to those that pose the greatest risks to people, property, or ecological attributes. For example, the aesthetics of scenic beauty was an important consideration in setting air quality standards for the area near the Grand Canyon [14].

Deliberate risk assessments are less likely to be limited by project length, resource distribution, or the complexity of management plans. They tend to be more limited by sustained interest of stakeholders and financial backing [7].

Immediate risk assessments focus on the impending or current crisis. Assessors adopt a triage approach with greater attention to human lives, loss of irreplaceable environmental services or resources, expensive economic scenarios, and extensive loss of property, usually in that order of priority. The speed of analysis and interpretation is improved by considering fewer options.

Immediate risk assessments are less likely to be limited by slow decision-making and tend to be limited to fewer options. That is, the options to solve the problem are focused on those that have the potential to greatly reduce deleterious effects. Moreover, the options may be limited by implementation time and by the resources accessible in the crisis area. Short-term access to skilled workers, equipment, materials, and funds may be limited, thus reducing options. For example, the only choice may be evacuation of an area; therefore, the options involve only the means to accomplish this.

Summarizing by examples, in a deliberate risk assessment, an assessor evaluates the risks and options for action regarding the planned removal of a dam. In an immediate risk assessment, the assessor evaluates the risks and options for action when a dam is in imminent danger of a breach.

3.3.2. Management Assessment

Deliberate management assessment considers the environmental decision options in light of economic, social, cultural, and other factors and values [2]. Because there is time and assessors and decision makers may need to justify decisions to stakeholders, they will more likely elect to perform surveys and gather socioeconomic data. They are more likely to balance multiple short- and long-term goals and perform decision analysis or cost-benefit analysis before choosing a management option.

Immediate management assessment is unlikely to use complex decision support systems unless assessors and decision makers are already familiar with the decision tools that are appropriate for the problem at hand. The severity of the threat overrides most other factors. While management decisions always integrate social, political, and economics costs, the information may encompass large uncertainties.

3.4. OUTCOME ASSESSMENT

Deliberate outcome assessments evaluate both the immediate impact of actions or lack of action and long-term outcomes. Cost, collateral damage, or long-term outcomes tend to be more important due to the lengthy time for implementation, visibility to society, and the nature of the types of problems. Outcome assessments that evaluate management actions that take a long time to complete are subject to second thoughts and interruption of

implementation. However, these same challenges can be used to update the management plan in an adaptive management approach. Deliberate outcome assessment may require long-term commitment to monitoring. For the example, in 2006, a Superfund remediation implementation plan for 39 miles of the Fox River (Wisconsin, USA) recommended a combination of dredging, capping, and other procedures that included monitoring before and after remediation to support an outcome assessment [17]. Remediation began in 2007 and will be followed by 40 years of monitoring and outcome assessments.

Immediate outcome assessments also evaluate the immediate impact of actions or lack of action. However, long-term outcome assessments usually revert to a deliberate approach [9]. During the immediate phase, it is less likely that collateral damage from the management action or damage to less obvious yet valuable environmental entities or functions will be assessed. For example, if the threat was an imminent hurricane, a management action may have removed ships from port, and the immediate phase of environmental outcome assessment might evaluate the number and effects of boats left in port, such as damage to reefs or toxic spills. However, once the assessment shifts to a deliberate approach, attention may shift to a wider array of assessment endpoints that are environmentally or politically important.

4. Discussion and Conclusion

Environmental assessments are among the most complex analyses and syntheses that humans undertake. Organization and simplification of immediate environmental assessments can help when decisions absolutely must be made. Organization and integration of deliberate environmental assessments can help avoid indecision when decisions would benefit environmental, social, cultural, and economic objectives.

Although most assessors are familiar with the conditions that warrant different approaches to assessments, clear terminology can make it easier to communicate and integrate across types of assessments. Furthermore, deliberate environmental assessments can greatly enhance the performance of assessors under duress. Deliberate assessments can provide analytical and decision support tools that are also applicable in an emergency. Deliberate assessments can make data sets accessible for unexpected situations; for example, geographically relevant distributions of ecological, human, and physical entities. Deliberate risk assessments typically develop risk models for a wide variety of chemical and more recently physical and biological stressors. Rather than report only risk estimates, the full risk model should be easily accessible so that undesirable but inevitable tradeoffs between

management objectives can be scientifically assessed in a crisis. Not only do immediate environmental assessments benefit from the products of deliberate assessments, but they also depend heavily on prior preparation. Therefore, continued development of decision support tools is needed to provide ready access to causal relationships or data and tools to quickly make scientifically informed decisions. Among these needs is the continued development of standard methods for recurring types of crises or situations that constrain time available for assessments and make these methods more widely available to smaller communities and the public.

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