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Moving to the New Paradigm

In the first part of this book environmental impact assessments were described procedurally; that is, in sequence from initial public scoping through data collection and analyses, alternative impacts, and writing the report. There are other ways of organizing and describing the environmental impact assessment process. One alternative is to look at core issues found among multiple components regardless of where in the assessment process they appear.

Core issues include—

- Ranking preferences.
- Quantifying significance, acceptability, sustainability and other societal values and beliefs.
- Describing environmental conditions by combining quantitative and qualitative environmental data to summarize and characterize these conditions.
- Impact inference, evaluation and assessment.
- Making multi-objective, multi-criteria decisions under conditions of uncertainty.

8.1 Tools for the New Paradigm

The tools now available to the EIA practitioner and decision-maker are many. All can address core issues and provide the basis for making a decision. Some of these tools are methods that use cardinal values (numbers) and some are methods that use ordinal values (words).

Some methods are computationally intensive and require a computer; other methods allow calculations using a spreadsheet or by hand while providing approximations adequate for many situations. All of these methods transform subjectivity into objectivity by an open, explainable process. The manipulations are mathematically sound and based on well-established theory and research.

8.2 Progress Toward Adoption

Environmental impact assessment practitioners and researchers have recognized the value of the modern approach. Various components and approaches have been used in a range of project types. Five such projects are summarized to illustrate the broad recognition that a new paradigm is necessary.

8.2.1 Mercury Bioaccumulation Risks

Viega and Meech [38] applied fuzzy logic to assess the environmental risks of mercury bioaccumulation associated with gold mining in operations in Brazil's Amazon region. As they point out, the fuzzy system model provides the same practical risk level results as a complex mathematical model but without the high costs, large amounts of data, and sophisticated technical skills to relate factors and bioaccumulation quantitatively. The authors developed a well-thought-out fuzzy expert system they call "HgEx" that "accommodates imprecise data input for variables, such as background level as well as how measurements are transformed into linguistic expressions with respective degrees of belief to be handle [*sic*] in a heuristic model (neural equations—Weighted Inference Method)."

Their approach uses a combination of a neural network[1] and a fuzzy expert system (called a *neuro-fuzzy* model) to address the problem. This approach uses a simple neural network to propagate weighted data evidence to a conclusion that forms the input to the approximate

[1] A neural network is a computer model that mimics the human brain's ability to identify patterns. While the outcome of the neural network can be proven correct it is not possible to determine exactly how the model derived that outcome.