Determining Environmental Impacts

How are environmental impacts determined?

General approach

- Identify likely impacts on environmental attributes
- Measure or quantify impacts on attributes
- The more significant the issue is, the more attention to detail and scope is required
- Define how the aggregate of project impacts will produce a total environmental impact
- Project project impacts over time and space

Limitations on scope and detail

- Resources available: time, people, skills, money, technology (computers), data needed to prepare an EIS
- Must balance against overall size and likely impact of a project
- Familiarity of preparers with critical issues and impacts
  - Is the team familiar with the project type and area
  - Important for EIS validity

Administrative constraints: are options, choices or methods limited by laws or regulations?

- E.g., regulations may specify less effective mitigation measures

Conceptual steps to determine environmental impacts

- Identify the most important potential impacts
- Difficult because the list of environmental attributes is nearly endless
- Avoid duplication and redundancy
- Do not automatically eliminate difficult to measure or obscure attributes in favor of easy to measure or obvious attributes
  - Choose attributes that best reflect anticipated impacts, regardless of difficulty
- How will characteristics of the project and the environment interact in time and space?
  - What are the environmental conditions before the activity?
  - How will the project affect the environment throughout project life?
  - How might project impacts differ in alternative geographic settings?
- Understand that attributes are surrogates for smears of interacting primary and secondary effects in the environment
  - Attributes may not reflect actual changes in the environment, but they are used to make the best possible *a priori* predictions and decisions
- Measure impacts: once impacts are identified, try to quantify them in a meaningful way
  - Base quantitative measures on the differences over time between predictions of changes with and without the project, not against a zero baseline; look at absolute and percentage changes
- Not always possible to quantify a loss (e.g., species extinction)
  - Use description/expert judgement to deal with non-quantifiable impacts
- Rate the relative importance of anticipated impacts; e.g., economic gain to community vs. loss of fish habitat
  - This is where most disputes over projects and EIS's arise
    - Different stakeholders bring different values to the process
    - Decisions are basically a subjective, negotiated process among professionals who prepare the EIS and stakeholders who review it within

- context of relevant laws and regulations
- Delphi Technique developed by Rand Co. is one way to rationalize the process among professionals
  - Repeated interdisciplinary meetings to rank the importance of impacts (USFWS sturgeon habitat Delphi)
- Examine potential secondary impacts carefully
  - Very important in the economic and ecology categories (consider ecosystem diversity, stability, succession)
  - Watch out for population changes due to projects that place more demands on the political and ecological systems
  - Consider cumulative impacts carefully
    - A series of small projects, each with minor impacts, can produce a program with major impacts (dams, boat launches, staged developments)
    - An EIS must always consider the whole project over time, not separate pieces (watch out for this tactic by project proponents)
- Sum up the aggregate + and -- impacts of the proposed project and reach a conclusion: do benefits outweigh the costs or vice versa?; go or no-go?

Specific steps to determine environmental impacts (compare above)

- Identify potential impacts
- Be comprehensive: address full range of potential biophysical/socioeconomic impacts
- Be specific: identify specific, critical attributes to be measured
- Isolate project impacts relative to future environmental changes caused by other factors
- Examine the timing and duration of short- and long-term impacts
- Measure/quantify impacts
  - Emphasize objective over subjective measures to the extent possible
  - Look for explicit, quantitative indicators of impact
  - Available data sources will influence ability to be quantitative
  - Is the magnitude of the impact large or small?

Interpret impacts (most critical part of EIS)

- Significance: need explicit assessment of likely impacts on appropriate spatial and temporal scales
- Criteria: what assumptions were used to determine significance?
- Uncertainty and Replicability
  - How reliable are the results (how confident are you in them)?
  - Are the methods used unambiguous?
  - Is analyst bias a problem?
- Risk: focus on impacts with a high probability of damage, even if the probability of occurrence is low (e.g., nuclear plant core meltdowns)
  - These issues engender strong public response
- Alternatives
  - What methods should be used to compare them?
  - What are the key differences in likely impacts among alternatives?
- Aggregation: if impacts have been combined to produce composite estimates of risk, identify the weighting criteria and assumptions used

Public involvement: for significant or controversial issues requiring value judgements, suggest mechanisms for public participation in decision-making

Communicating impacts to stakeholders and the public

Provide a readable executive summary that:

Provides a complete description of the project/environmental setting

Summarizes the key results of the EIS in relation to the 8 CEQ points

Highlights the most important adverse impacts and links them to specific environmental attributes and stakeholders

Avoids confusing math, statistics, technical detail

Choose an appropriate EIS methodology

Is the EIS to be an information or decision document?

Information: focus on implications of project, interpretation, alternatives

Decision: focus on quantitative indicators, best course of action

Are the alternatives fundamentally or incrementally different?

Fundamental: e.g., flood control by zoning vs. levee (evaluate both against an absolute standard of no protection/current situation)

Incremental: e.g., how high to make the levee (use direct quantitative comparisons of effect vs. height)

General EIS preparation methods used to evaluate impacts

Ad Hoc: suggests broad areas of possible impacts (e.g., flora, lake) vs. defining specific attributes (e.g., endangered plant, nutrient cycling)

Overlays: use overlay maps to project environmental characters (biophysical, socioeconmic) of an area with and without project

Provides composite view of impacts, but may miss complex effects

Modern GIS technology greatly enhances this approach

Checklists: present specific lists of environmental issues to be addressed

Matrices: lists of project activities compared to potential impacts in attempt to establish relationships and specify significant impacts

Networks: attempt to establish cause-effect relationships

Combination, usually computer-assisted, usually used; Identify:

Activities associated with project

Likely environmental impacts

Mititgations and alternatives

Models to identify potential cause-effect relationships and quantify/predict impacts

Procedures for reviewing an EIS that should be used by preparers and reviewers to assess completeness, accuracy and validity of the EIS

The review process should allow people to become familiar with the project quickly and let them ask substantive questions about the EIS

Define project characteristics with a set of screening questions to produce a rating score that broadly characterizes projects by their potential impacts

Tables 7.1, 7.2 show rating questions/answers for a typical construction project

Questions can easily be modified to suit other types of projects or programs

Figure 7.1 shows flowchart of the procedure

Purpose is to categorize projects as having small, moderate or large impacts

Uses 12 questions with values of 0, 5 or 10 points

0-59 points = small, 60-99 = medium, 100-120 = large impact

Depending on how large the anticipated impacts will be, different and increasingly detailed review criteria can be used to more completely describe and evaluate project impacts (Tables 7.3, 7.4, 7.5)

Review criteria are divided into Completeness and Accuracy categories:

Completeness: do the potential impacts described in the EIS meet the full disclosure requirements of NEPA/ SEPA, etc.?

Accuracy: is all relevant information included and correct?

Size of project impact determines the intensity/detail of the EIS/ review process

Agencies have their own review criteria to determine if an EIS is prepared correctly; you can use their procedures or create your own for a project