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Trade-off Analysis and Public Involvement



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Agenda

- ◆ What is Tradeoff Analysis
- ◆ Lessons from Theory
- ◆ Challenges Working with Stakeholders
- ◆ Review of Methods
- ◆ Lessons from Practice
- ◆ Research Needs

Public Participation is:

- Something we have to do before we can get on with forest management
- A way to gauge public perceptions to set forest policy once and for all
- A replacement for self-help groups and therapy for job related dysfunction
- A new way of doing business

A new way of doing business.

The public will be permanently involved in a continuous improvement loop.

Make a list of trade-offs that you are dealing with now.

We will discuss these in 5 minutes.

Types of Tradeoffs

- ◆ Inter-temporal tradeoffs
- ◆ Ecosystem capital tradeoffs
 - Conversion of forests
- ◆ Jobs vs. Environment (is it really?)
- ◆ Forest outputs against one another
- ◆ Use vs. Non-use
- ◆ Others?

Tradeoff Analysis is:

- Understanding how people value various “aspects” of the forest
- Conducting cost/benefit analysis
- Finding workable solution to satisfy a group of stakeholders
- All of these things

Discussion Question

In establishing a stakeholder's preference for something, does the cost of producing it really matter?

Economic Theory on Tradeoffs

- ◆ Maximize social welfare from public land
 - Social welfare function
 - Joint production function
- ◆ Conditions for social efficiency:
 1. Relative value of any two forest outputs (MRS) the same across all consumers
 2. The rate which inputs can be substituted for one another in production of any output is the same across all outputs
 3. Relative value of two outputs equal to production tradeoff (MRS=MRT)

(Stevens and Montgomery 2002)

Economic Theory

- ◆ Maximize social welfare from public land
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- ◆ Conditions:
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 3. Relative value of two outputs equal to production tradeoff (MRS=MRT)

This condition gets at how stakeholders value forest outputs.

Economic Theory

- ◆ Maximize social welfare from public land
 - Social welfare function
 - Joint production function
- ◆ Conditions:
 1. Relative value of any two forest outputs
 2. Opportunity cost of producing an output in terms of forgone production of the other output.
 3. Relative value of two outputs is equal to production tradeoff (MRS=MRT)

Relative value of any two forest outputs

Opportunity cost of producing an output in terms of forgone production of the other output.

Two Key Results

- ◆ Requires knowledge of how stakeholders value outputs relative to one another
- ◆ Requires knowledge of the opportunity cost of producing various outputs

Cannot get both of these from stakeholders alone.

The Nature of Tradeoffs

Tradeoffs inherently involve not only what is desired but also what is possible.

What problems have you experienced with public involvement and tradeoff analysis?

Problems Experienced



Challenges Involving Stakeholders

- ◆ Multiple Value Dimensions
 - Ecological, Social, Economic
 - Temporal
 - Spatial
- ◆ Uncertainty About Consequences
 - Lack of knowledge or tools
 - Result not predictable
- ◆ Unfamiliar Evaluation Context

(from Gregory 2002)

Challenges Involving Stakeholders

- ◆ **Balancing Effort and Accuracy**
 - Too hard to get people to think
 - Groups don't always solve the problem
- ◆ **Incorporating Affect and Process**
 - Difficult to include feelings
 - Importance of trust in the process and decision makers
- ◆ **Learning Over Time**

(from Gregory 2002)

Arrow's Impossibility Theorem

Even if individuals could perfectly rank alternatives

No global societal preference order can be fairly determined from aggregating individuals' preferences.

Trade-off Analysis Methods

1. Determine and validate criteria and indicators
2. Assess stakeholder values and preferences
3. Determine opportunity costs of alternatives
4. Develop multi-criteria management plans
5. Determine social acceptability of alternatives
6. Incorporate single/multiple stakeholder in generating & approving alternatives

Trade-off Analysis Methods Typically Involving Stakeholders

1. Determine and validate criteria and indicators
2. Assess stakeholder values and preferences
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5. Determine social acceptability of alternatives
6. Incorporate single/multiple stakeholder in generating alternatives

1. Determine and validate criteria and indicators

<p style="text-align: center;">Rationale</p> <p>C&I cover a wide range of forest values that require acceptance by stakeholders</p>	<p style="text-align: center;">Status</p> <p>Ecological</p> <ul style="list-style-type: none"> ◆ Tons of research ◆ Some strong, measurable indicators, biodiversity ??? <p>Economic</p> <ul style="list-style-type: none"> ◆ Non-timber unknown ◆ Timber related indicators poor <p>Social</p> <ul style="list-style-type: none"> ◆ Difficult to isolate to the sector and to the proper scale ◆ Need a lot of work and realism
<p style="text-align: center;">Methods</p> <ul style="list-style-type: none"> ◆ Influence diagrams and hierarchical structures ◆ Expert evaluation using mathematical and other techniques ◆ Simulate natural systems to understand behavior of C&I ◆ Ranking, rating, pair wise comparisons (AHP), voting 	

Concerns

- ◆ Analysis difficulty explodes as number of indicators increase
- ◆ Indicator must be measurable
- ◆ Indicator must connect to management plan

Tools

- ◆ Cognitive Mapping
- ◆ Ranking / Rating

2. Assess stakeholder values and preferences

<p style="text-align: center;">Rationale</p> <p>Stakeholder elicit their choices between alternative criteria with a variety of mechanisms</p>	<p style="text-align: center;">Status</p> <p>Pros</p> <ul style="list-style-type: none"> ◆ Literature very strong in this area ◆ Research underway to address some of Gregory's challenges <p>Cons</p> <ul style="list-style-type: none"> ◆ Once preferences are known, still have to create a plan ◆ Plan may not agree with stated preferences ◆ Learning and interaction required to get buy-in in the <i>process</i>
<p style="text-align: center;">Methods</p> <ul style="list-style-type: none"> ◆ Ranking and rating to identify meaningful values ◆ Apply voting theory to select relevant values ◆ Employ willingness to pay methods to assess non-economic values 	

Concerns

- ◆ Individual Values vs. Social Values
 - We ask people what they prefer, rather than what they think should happen
- ◆ Preference Evolve with Learning
 - People change their mind when they see the costs

These suggest public should be involved in the process of planning.

Tools

- ◆ Cognitive Mapping
- ◆ Ranking / Rating
- ◆ Analytic Hierarchy Process
- ◆ Willingness to Pay Surveys

WTP vs. WTAP

- ◆ The are often confused
- ◆ If user already has the property right
 - Use WTAP payment to give it away.
- ◆ If user wants the property right
 - Ask for WTP to purchase it.

Neither method is reliable, studies have shown participants exaggerate their WTP or WTA.

Guidelines for Contingent Valuation

- ◆ Sample size of 1,000 required
- ◆ Face to face interviewing best
- ◆ Full reporting of data & questions required
- ◆ Design should be conservative
- ◆ WTP better than WTAP
- ◆ Valuation should be a vote (yes or no) on a dichotomous choice question.

3. Analyze opportunity costs of alternatives

Rationale

To determine the cost of achieving SFM results in terms of the other indicators.

Methods

- ◆ Economic Theory
- ◆ Cost / Benefit analysis
- ◆ Mathematical models, optimization and simulation

Status

Pros

- ◆ A variety of mathematical models are available

Cons

- ◆ Different valuation units make comparisons difficult
- ◆ Impossible to integrate social / distributional indicators
- ◆ Temporal tradeoffs hard to quantify
- ◆ More collaboration needed

4. Develop multi-criteria management plans

Rationale

Develop spatial and temporal SFM plans for evaluation by stakeholders.

Methods

- ◆ Multi-criteria optimization models
- ◆ Growth and yield forecasting
- ◆ Habitat models

Status

Pros

- ◆ Long history of development, and very strong research expertise

Cons

- ◆ Models require weights or targets involving stakeholders
- ◆ Effect of management decisions on many indicators unknown
- ◆ Good models for timber growth but not for non-timber ecological indicators

State of the Art

- ◆ Planning models connected to GIS Systems
- ◆ Able to deal with a wide variety of constraints
- ◆ Getting better with ecological tradeoffs
- ◆ Virtually no social tradeoffs being modeled

Concerns

- ◆ Too focused on timber volume as the output
- ◆ Controlled by monkeying around with criteria weights instead of visa-versa
- ◆ Inventory data unreliable
- ◆ Little data on non-timber values & especially growth of these

Case Study – Eastern BC

Developing a multi-criteria management plan.

Criteria and Indicators

I. Biological Richness

- ◆ Ecologically-distinct ecosystem types are represented (EG1, EG3, EG7)
- ◆ Stand and forest-level habitat elements are represented (OGMA)

II. Productivity

- ◆ Annual removal is sustainable

Criteria and Indicators

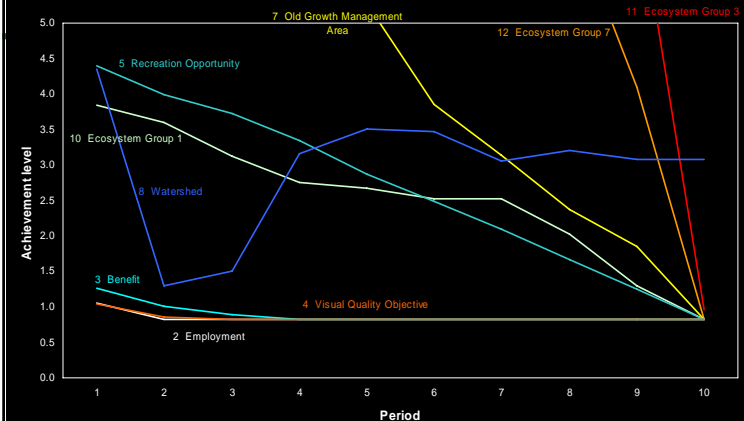
III. Economic Benefits

- ◆ Profitability & Tax Revenue
- ◆ Employment in all sectors
- ◆ Stumpage revenues to the crown

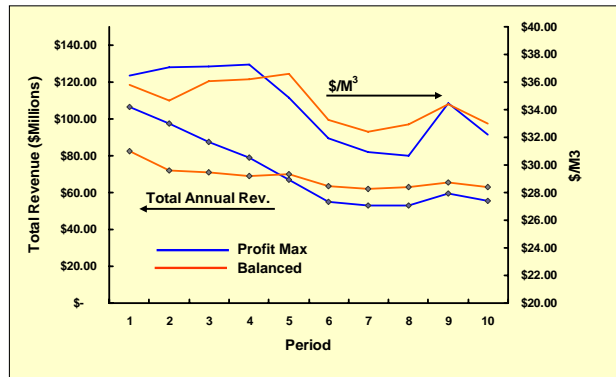
IV. Quality of Life

- ◆ Availability of recreation opportunities
- ◆ Visual quality objectives
- ◆ Community watersheds are protected

Achievement levels for all Criteria I - IV



Revenue Comparison



Social Indicators and Trade-Off Analysis in Natural Resource Planning, Operations and Policy

Trade-off Analysis

Tradeoff Analysis

	EG1	EG3	EG7	OGMA	PFT	EMP	BFT	REC	VQO	WAT	Min
EG1	1.00	1.00	0.82	0.82	0.82	0.82	0.82	0.82	0.82	1.37	0.82
EG3	0.59	1.00	0.46	4.40	0.46	0.00	0.00	2.19	0.90	3.38	0.00
EG7	0.00	0.78	1.00	9.87	0.44	0.00	0.00	2.56	0.68	2.69	0.00
OGMA	0.80	0.80	0.80	1.00	0.80	0.80	0.80	0.80	0.80	1.32	0.80
PFT	0.00	0.52	0.31	0.00	1.00	0.10	0.62	0.08	0.53	1.82	0.00
EMP	0.51	0.51	0.51	1.56	0.63	1.00	0.51	1.49	0.72	2.03	0.51
BFT	0.71	1.21	3.13	0.85	0.80		1.00	0.71	0.75	1.33	0.71
REC	1.42	4.88	0.45	7.53	0.45	0.00	0.00	1.00	0.80	3.74	0.00
VQO	0.73	5.01	0.98	0.73	0.73	0.73	0.73	0.98	1.00	1.52	0.73
WAT	0.37	4.30	1.93	1.04	0.57	0.37	0.37	1.69	0.84	1.00	0.37

5. Assess social acceptability of alternative plans

Rationale
Present management plans to stakeholders for ranking.

Methods
♦ Ranking, pair wise comparison (AHP) and voting theory to select the desired alternative

Status

Pros

- ♦ Clear choices
- ♦ Public involved

Cons

- ♦ Stakeholders not involved in plan development
- ♦ Difficult to assess impacts on areas of concern
- ♦ No mechanism for learning

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Trade-off Analysis

6. Involve stakeholder in generating alternatives

Rationale
Stakeholder is involved through plan review and feedback.

Methods

- ♦ Interactive mathematical / visual models with a single stakeholders
- ♦ Combination of outranking and mathematical methods that requires multiple stakeholders to input their preferences, analyze the consequences and select the desired alternative

Status

Pros

- ♦ Stakeholder clearly involved in process
- ♦ Stakeholders learn about challenges

Cons

- ♦ Extremely complex interaction
- ♦ Experts required to tweak models
- ♦ Difficult to assess impacts on areas of concern
- ♦ Gregory's challenges still apply

Social Indicators and Trade-Off Analysis in Natural Resource Planning, Operations and Policy

Trade-off Analysis

Structured Approach to Participatory Decisions

1. Frame the decision
2. Define the objectives
3. Establish Alternatives
4. Identify Consequences
5. Clarify Tradeoffs

From Gregory (2000)

How are you involving stakeholders?

Lay out a step by process of how stakeholders are involved and then we will discuss it.

What we have learned

- ◆ Public preferences must guide the development of policy alternatives.
- ◆ Educate the public during the process of developing alternatives – **Check Back**
- ◆ Put together an acceptable list of policy alternatives – cannot find the optimal plan – **There isn't one!!!**

Consensus on Values

- ◆ Cannot achieve consensus on values
- ◆ Cannot “average” values
- ◆ People will agree to a “model plan” for their own reasons, can achieve acceptability.

Develop common plans not common values

Step by Step Process

1. Group discussion of preferences makes people aware of wide range of values.
2. A set of policy alternatives proposed to investigate how values change.
3. Management plans developed on the alternatives. Public involved in mid term review. **Not at end.**

Step by Step Process

4. Alternatives described in terms of how values are affected.
5. Consensus achieved on characteristics of the plan.
6. Implementation
7. Continuous Improvement through the quality improvement program.

Continuous Improvement

- ◆ Policy is continually evolving as:
 - We learn more
 - Preferences change
 - We see the results of our policies
 - Unforeseen events happen
- ◆ This is normal and expected
- ◆ Policy changes should be small and incremental

Stakeholder Buy-in

- ◆ Stakeholders accept the outcome more easily if:
 - They were part of the analysis team
 - They know it will be revisited
 - They know outsiders are looking in

Importance of Watchdogs

- ◆ Policy analysis can't include every option, every value
- ◆ Watchdogs look out for the interests and trigger continuous improvement

Incorporating Ethics

- ◆ The Land Ethic – Aldo Leopold
- ◆ We often don't make the best economic decision
- ◆ How can we incorporate this into our planning?

"This extension of ethics, so far studied only by philosophers, is actually a process in ecological evolution."
A. Leopold, *The Land Ethic*

Minimum Safe Standards

- ◆ Two considerations for planning
 - Magnitude of impact
 - Degree of reversibility
- ◆ Strategy
 - Reversible, low impact (proceed to planning)
 - Irreversible, high impact (ethics imposed)

Current Research - Trade Off Analysis

- ◆ Developing appropriate C&I
 - Still not there yet
- ◆ Getting information on large scale areas pertaining to the C&I
- ◆ Better forecasting tools to
 - Determine impact of decisions on non-timber indicators
 - Integrate the value chain
- ◆ Methods to review results with stakeholders and gauge result

Conclusions

- ◆ Because public is so unfamiliar with these decisions, non-biased experts generate alternative plans in consultation with public
- ◆ Public iteratively views the plans stating how they feel about the plan and the process and scenarios evolve
- ◆ The public learns about consequences and they balance their values and preferences according

Conclusions

- ◆ Watchdogs look out for overlooked values
- ◆ Incremental policies enacted, planning process never ending
- ◆ Planning tools improve through objective use

Research Needs

Research Areas

- ◆ Use *combination* of methods that:
 - Integrate Forest to Product value chain
 - Encourage learning about:
 - » Decision process
 - » Natural environment
 - » Stakeholder's value system
 - Incorporate cognitive aspects
- ◆ Continue to develop meaningful, operational criteria and indicators for SFM

Research Needs – C&I

- ◆ Developing appropriate C&I for Mgt Plan Development
 - Not there yet
 - Special problems with social and economic
- ◆ Getting information on planning areas pertaining to the C&I
 - C&I worthless without this

Research Needs – Modeling

- ◆ Forecast models on future forest condition pertaining to non-timber
- ◆ Methods to assess impact of harvesting on non-timber C&I
- ◆ Methods to scoring and rank impacts of mgt decisions
- ◆ Integration of existing models

Research Needs – Stakeholder Interaction

- ◆ New ways of working / reviewing outputs with stakeholders
- ◆ Learning tools – “Expert” Systems instead of optimization models
- ◆ Methods to balance opportunity costs and value tradeoffs
- ◆ Better integration of existing models
- ◆ Interdisciplinary teams of experts to act as interface with models and forest

Concluding Remarks

- ◆ Can't expect public to be forest managers
- ◆ Many researchers working in isolation on parts of the problem
- ◆ Essential to integrate the entire value chain – many indicators are complementary
- ◆ Complex, interdisciplinary teams needed to develop methods and framework