Economic Valuation of Environmental Quality Changes from Tourism / Recreation Demand: An Assessment of Current Practice and Challenges for the Future

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Overview

- Motivation – Recreation / Tourism and Environmental Quality Change
- History
  - How have we analyzed recreation / tourism behavior? – a quick review
- Reframing the issue – analysis of “choice”.
Why recreation / tourism values?

- Measureable and potentially “capturable” environmental value based on behavior
- Responsive to environmental quality changes
  - Potentially a key component of ecosystem service valuation (endpoint)
  - Millennium Ecosystem Assessment
- Example: NatCap InVEST Tool
  - Measure impact of land use decisions on carbon, water, recreation, biodiversity – core endpoints.
  - [http://www.naturalcapitalproject.org/toolbox.html](http://www.naturalcapitalproject.org/toolbox.html)
- Challenging microeconometric problem (Phaneuf and Smith, 2005)
- Growth Sector (??)

Source: Pergams and Saradic (2008) PNAS. Page 2296
Analysis of Trends

- Declining per capita participation in nature based recreation
- Links to alternate uses of time (home movies, internet use, etc.) and “prices”
- Some exceptions
  - Unique hiking opportunities
  - International travel (see Balmford et al 2008)
- Balmford et al report increases in use of protected areas in all regions but North American and Australasia.
  - Large increases in Africa and Asia
- Will environmental improvements (or prevention of environmental decline) generate economic welfare?
A Quick Summary of Recreation Demand Models
Publication Trends – Recreation Demand, Travel Cost Model

Refereed Publications (EconLit)

Recreation Demand  Travel Cost Model
Publication Trends – Recreation Demand, other Valuation Methods

Refereed Publications (EconLit)
Travel Cost Models

- Utility = f(Trips$_j$, Time$_j$(?), Other Goods)
  - Subject to: Income Constraint (?)
  - Subject to: Time Constraints

- Key demand analysis issues
  - Separability over “goods” (spatial; associated goods)
  - Separability over “time”
  - Multi-purpose trips
  - Constraints

- Disaggregate econometric analysis
Resulting Models

- Single site travel cost model
- Multiple site models (count, systems)
- Random Utility Model
- Corner Solutions Models (Kuhn-Tucker models)
A Digression: LaMondia, Bhat and Hensher (2007) Model of Vacation Time Use

- Model choice of time to spend in each of 5 vacation activities (including recreation)
  - Unique utility and separability structure
  - Equate marginal utilities of time use
  - Mix (choice and frequency) of time use specified as a function of demographics and residence location
- Discrete continuous framework for time-use decisions.
- Explains vacation time use patterns, but difficult to incorporate “prices” or assess welfare effects of quality changes.
Reframing - A general model of choice?

- Choice (trips, destination, etc.) as the outcome of a
  - decision strategy (D);
  - choice set (C);
  - preference function (V) and
  - error component $\varepsilon$, over time and space.

$$i^*_n \leftarrow D(\Omega)_n \left\{ V(\Omega)_{jn}, \varepsilon(\Omega)_{jn} \right\}_{j \in C(\Omega)_{nt}}$$

Swait et al, 2002
**Decision Strategy**
- Utility maximization
- Heuristics

**What is in the utility function**
- Heterogeneity
- Perceptions (memory)
- Reference Dependence
- Interdependence (endogeneity)

\[
i^*_n \leftarrow D(\Omega) \bigg\{ V(\Omega)_{jnt}, \varepsilon(\Omega)_{jnt} \bigg\}
\]

**How time affects the decision**
- Duration
- Planning horizon
- Learning / Habits / Experience

**Choice Set**
\[ j \in C(\Omega)_n \]

**Unobserved components**
- Heterogeneity

**What data are used to assess these decisions?**

**How do we integrate economic and ecological models?**
Data Generating Mechanisms
Data Generating Mechanisms

- Revealed Preference Data
  - Not always adequate?
- Stated Preference Data
  - Some experimental control options, but…
- Quasi Experiments?
  - Few examples in this literature – but several opportunities…
- Data Fusion
  - Data fusion to enhance identification / estimation
  - Experiments informing stated preference designs
  - Preference Calibration (Smith et al).
Revealed Preference Data

- A chronic problem in the area
  - Some general population surveys exist
  - Surveys of specific populations
    - Hunters, anglers, rock climbers, etc.
  - On-site surveys
  - Convenience samples
- Data problems
  - Collinearity, lack of variation
  - Measurement error; perceptions
  - Response bias
Stated Preference Data – Choice Experiments

- Ideally suited to problems when:
  - Need to estimate demand for new products, services or options available, with new attributes or features.
  - No RP data on which to rely.
  - Explanatory variables have little variability in the “real world”.
  - New variables now explain choices.
  - A new market structure is being considered
  - Endogeneity exists
  - Existing institutional structure restricts expression of “true preferences” (someone else makes the choices?!).
Example of a Choice Task:

<table>
<thead>
<tr>
<th>Features of Recreation Areas</th>
<th>Site A</th>
<th>Site B</th>
<th>Neither Site A or Site B appeals to me</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance from home to recreation area</td>
<td>250 Kilometers</td>
<td>425 Kilometers</td>
<td></td>
</tr>
<tr>
<td>Access within recreation area</td>
<td>Passable with a 4WD vehicle</td>
<td>Passable with a 2WD vehicle</td>
<td></td>
</tr>
<tr>
<td>Encounters with other recreationists</td>
<td>Other people, on foot, are encountered</td>
<td>Other people, on ATV’s, are encountered</td>
<td></td>
</tr>
<tr>
<td>Evidence of forestry activity</td>
<td>Little or no evidence of logging</td>
<td>Large, straight edged clear-cut areas, no residual trees</td>
<td></td>
</tr>
<tr>
<td>Moose populations</td>
<td>Evidence of 1 Moose per day</td>
<td>Evidence of 1 Moose every 2 days</td>
<td></td>
</tr>
<tr>
<td>Wildlife species opportunities to see...</td>
<td>Common species of wildlife, 1 or 2 species you’ve never seen before, and a chance of seeing a rare or endangered species</td>
<td>Common species of wildlife, 1 or 2 species you’ve never seen before</td>
<td></td>
</tr>
</tbody>
</table>

**Which site would you choose for your next hunting trip?**

( 科 only one box at right)

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**Figure 1.** One of the 28 choice sets (or scenarios) used in the choice experiment for hunters. The wildlife viewing scenarios were identical except for replacement of the term “viewing” for “hunting” in the presentation.
### ABSCM Task

#### Situation 5 Version 2

<table>
<thead>
<tr>
<th>FEATURES</th>
<th>Woodland Caribou</th>
<th>Quetico</th>
<th>Boundary Waters Canoe Area</th>
<th>Wabakimi</th>
<th>Nopiming and Atikaki</th>
<th>Stay at home</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Fee ($Cdn)</td>
<td>$5.00</td>
<td>None</td>
<td>None</td>
<td>$5.00</td>
<td>$15.00</td>
<td>I would not visit any of these parks</td>
</tr>
<tr>
<td>Chance of entry</td>
<td>1 in 2</td>
<td>1 in 2</td>
<td>1 in 2</td>
<td>1 in 4</td>
<td>Always get in</td>
<td></td>
</tr>
<tr>
<td>Campsite</td>
<td>Pad &amp; toilet</td>
<td>Anywhere</td>
<td>Designated</td>
<td>Pad &amp; toilet</td>
<td>Anywhere</td>
<td></td>
</tr>
<tr>
<td>Development</td>
<td>Cottages</td>
<td>Cottages</td>
<td>Lodges</td>
<td>Outposts</td>
<td>Lodges</td>
<td></td>
</tr>
<tr>
<td>Encounters</td>
<td>4-9</td>
<td>1-3</td>
<td>4-9</td>
<td>4-9</td>
<td>1-3</td>
<td></td>
</tr>
</tbody>
</table>

a. Suppose only the parks shown above were available to you. Which park would you choose? (check only one)

<table>
<thead>
<tr>
<th>(check only one)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b. Suppose the park you chose in question a was unavailable. What would your second choice be? (check only one)

<table>
<thead>
<tr>
<th>(check only one)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# A Campsite Choice Survey Instrument

## Features

<table>
<thead>
<tr>
<th>Facilities</th>
<th>User Maintained</th>
<th>Random</th>
<th>Forest or Provincial Recreation Area</th>
<th>Forest or Provincial Recreation Area</th>
<th>William A. Switzer Provincial Park</th>
<th>Jasper National Park</th>
<th>Stay home</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pit toilets, fire pits, picnic tables, not serviced</td>
<td>No facilities, not serviced</td>
<td>Pit toilets, fire pits, picnic tables, gravel tent pads, water pumps, garbage cans, serviced</td>
<td>Pit toilets, fire pits, picnic tables, gravel tent pads, water pumps, garbage cans, serviced</td>
<td>Same as Forest/Provincial areas plus flush toilets, showers, electrical hookups, dump station, educational programs, serviced</td>
<td>Same as Forest/Provincial areas plus flush toilets, showers, electrical hookups, dump station, educational programs, serviced</td>
<td>Same as Forest/Provincial areas plus flush toilets, showers, electrical hookups, dump station, educational programs, serviced</td>
<td>Same as Forest/Provincial areas plus flush toilets, showers, electrical hookups, dump station, educational programs, serviced</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Camping fee (per night)</th>
<th>User Maintained</th>
<th>Random</th>
<th>Forest or Provincial Recreation Area</th>
<th>Forest or Provincial Recreation Area</th>
<th>William A. Switzer Provincial Park</th>
<th>Jasper National Park</th>
<th>Stay home</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>None</td>
<td>$15.00</td>
<td>$20.00</td>
<td>$15.00</td>
<td>Same as Forest/Provincial areas plus flush toilets, showers, electrical hookups, dump station, educational programs, serviced</td>
<td>Same as Forest/Provincial areas plus flush toilets, showers, electrical hookups, dump station, educational programs, serviced</td>
<td>Same as Forest/Provincial areas plus flush toilets, showers, electrical hookups, dump station, educational programs, serviced</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Firewood</th>
<th>User Maintained</th>
<th>Random</th>
<th>Forest or Provincial Recreation Area</th>
<th>Forest or Provincial Recreation Area</th>
<th>William A. Switzer Provincial Park</th>
<th>Jasper National Park</th>
<th>Stay home</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>Same as Forest/Provincial areas plus flush toilets, showers, electrical hookups, dump station, educational programs, serviced</td>
<td>Same as Forest/Provincial areas plus flush toilets, showers, electrical hookups, dump station, educational programs, serviced</td>
<td>Same as Forest/Provincial areas plus flush toilets, showers, electrical hookups, dump station, educational programs, serviced</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Regulations</th>
<th>User Maintained</th>
<th>Random</th>
<th>Forest or Provincial Recreation Area</th>
<th>Forest or Provincial Recreation Area</th>
<th>William A. Switzer Provincial Park</th>
<th>Jasper National Park</th>
<th>Stay home</th>
</tr>
</thead>
<tbody>
<tr>
<td>No OHVs, no horses</td>
<td>Horses, no OHVs</td>
<td>Horses, no OHVs</td>
<td>No horses</td>
<td>Same as Forest/Provincial areas plus flush toilets, showers, electrical hookups, dump station, educational programs, serviced</td>
<td>Same as Forest/Provincial areas plus flush toilets, showers, electrical hookups, dump station, educational programs, serviced</td>
<td>Same as Forest/Provincial areas plus flush toilets, showers, electrical hookups, dump station, educational programs, serviced</td>
<td>Same as Forest/Provincial areas plus flush toilets, showers, electrical hookups, dump station, educational programs, serviced</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fishing</th>
<th>User Maintained</th>
<th>Random</th>
<th>Forest or Provincial Recreation Area</th>
<th>Forest or Provincial Recreation Area</th>
<th>William A. Switzer Provincial Park</th>
<th>Jasper National Park</th>
<th>Stay home</th>
</tr>
</thead>
<tbody>
<tr>
<td>Streams or rivers</td>
<td>No fishing</td>
<td>Stocked lakes or ponds</td>
<td>No fishing</td>
<td>Lakes or ponds (not stocked)</td>
<td>Lakes or ponds (not stocked)</td>
<td>Lakes or ponds (not stocked)</td>
<td>Lakes or ponds (not stocked)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wildlife</th>
<th>User Maintained</th>
<th>Random</th>
<th>Forest or Provincial Recreation Area</th>
<th>Forest or Provincial Recreation Area</th>
<th>William A. Switzer Provincial Park</th>
<th>Jasper National Park</th>
<th>Stay home</th>
</tr>
</thead>
<tbody>
<tr>
<td>No moose, deer, or elk</td>
<td>See moose, deer, or elk</td>
<td>No moose, deer, or elk</td>
<td>No moose, deer, or elk</td>
<td>No moose, deer, or elk</td>
<td>No moose, deer, or elk</td>
<td>No moose, deer, or elk</td>
<td>No moose, deer, or elk</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Road quality</th>
<th>User Maintained</th>
<th>Random</th>
<th>Forest or Provincial Recreation Area</th>
<th>Forest or Provincial Recreation Area</th>
<th>William A. Switzer Provincial Park</th>
<th>Jasper National Park</th>
<th>Stay home</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved gravel, no logging trucks</td>
<td>Improved gravel, logging trucks</td>
<td>Improved gravel, no logging trucks</td>
<td>Unimproved gravel, no logging trucks</td>
<td>Paved, no logging trucks</td>
<td>Paved, no logging trucks</td>
<td>Paved, no logging trucks</td>
<td>Paved, no logging trucks</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>User Maintained</th>
<th>Random</th>
<th>Forest or Provincial Recreation Area</th>
<th>Forest or Provincial Recreation Area</th>
<th>William A. Switzer Provincial Park</th>
<th>Jasper National Park</th>
<th>Stay home</th>
</tr>
</thead>
<tbody>
<tr>
<td>Near Grande Cache (Site E)</td>
<td>Near Grande Cache (Site E)</td>
<td>Near Edson (Site A)</td>
<td>Near Edson (Site A)</td>
<td>Near Edson (Site A)</td>
<td>Near Edson (Site A)</td>
<td>Near Edson (Site A)</td>
<td>Near Edson (Site A)</td>
</tr>
</tbody>
</table>

## Questions

a) Which of the above camping options would you choose? (Check only one)

b) If your first choice was unavailable, what would your second choice be? (Check only one)
Disadvantages of SP Approach

- Hypothetical bias
- Complexity / cognition / learning / fatigue
- Labeled tasks versus generic designs
  - Unobserved attribute information
- Decisions on attributes, levels, experimental design
- Sampling?
  - Similar issues as in revealed preference
Data Fusion – the best of both worlds?

"Our worst nightmare: A technique that combines all the problems of Random Utility Models and contingent valuation"

Reviewer of Adamowicz, Louviere and Swait, 1997.
Data Fusion

- Why combine data types?
  - “Triangulation”
  - Address limitations in market data (e.g. Petersen, 1981)
  - Improved prediction / welfare measurement

- But,…
  - Should we expect preference information to be consistent across data types?
    - Which components of preferences will be consistent?
  - How does heterogeneity affect data fusion?
  - How do unobserved attributes / alternatives affect data fusion?
Examine 2 case studies of “typical” RP/SP data with a small number of RP sites

Combine approach from I-O (e.g. Murdoch, 2006) to address unobserved attribute information with RP/SP approach to address limited variation in data

Include RP data, SP data, ASCs and heterogeneity in estimation

Large statistical improvement in using RP/SP and ASCs

RP and SP do not reflect the same preferences!

Importance of examining unobserved attributes for estimating welfare measures.
Choice Sets
Choice Sets

- Fundamental to all demand analysis – particularly discrete choice models
  - What is in the choice set?
- Researcher Defined? (most common)
- Manski Model:
  \[ P_i = \sum_{C \in G_n} P_{i|C} Q_C \]
- Haab and Hicks - Endogenous Choice Set
- Independent Availability Model (Swait 1984)
- GenL (Swait 2002)
  - Generalized Extreme Value Form
- von Haefen – Latent Consideration Set Model
But what are the behavioural foundations of choice sets?

- **Effort/Accuracy Tradeoff**
  - Cost of Thinking (Shugan, Mktg Sci, 1980)
  - Decision Strategies (Payne, Bettman, and Johnson, )

- **Uncertainty about states of nature** (Kreps, 1979)

\[
V(x) = \sum_s p(s) \max_{z \in x} [U(z, s)]
\]

- **Satisfaction and Regret**
  - Too much choice?
    - (Iyengar and Lepper, JPSP, 2000; Iyengar and Schwartz, SCP, 2006)
  - Manipulation of the choice set

Source: Swait, Adamowicz and Johnson, 2006
Two types of choice sets

- **Predefined sets.**
- **Self-defined sets.** RPs had access to the universal set and were shown one item at a time. After viewing each item they could include or exclude it from the set, and decide whether to keep searching. When they decided to stop searching, they chose an item to purchase from their final choice set.

Examined how people choose the set of items in the “choice set”
Latent Classes of Screening Process

- Two latent classes appeared.
  - Class 1 (33% of sample) seems to alternatives based on attributes alone
  - Class 2 (67% of sample) ignores current attributes and uses the entropy and size of the current choice set to decide whether to include the alternative. This result is affected by Maximization and Regret interactions.
    - In this class – people who are “maximizers” appear to be attempting to increase the “entropy” (coverage) of their choice set
Relevance to Recreation Demand

- Heterogeneity in choice set composition is important
  - Maximizers choose different types of choice sets and search differently

- Some individuals will feel more satisfaction from smaller choice sets
  - What process do they use to “reduce” the choice set (Kreps Model)?
  - Consistency with welfare economics?
  - Requirement to incorporate processing costs, complexity into choice set and preference analysis.
Heterogeneity

- Immense concern over the past decade
- Observable Heterogeneity
  - Demographics, etc.
- Unobserved Heterogeneity
  - Mixed logit formulation
    - Popular, powerful approach
  - Latent class formulation
- Scale Heterogeneity
  - Observed and unobserved
The Heteroscedastic MNL Model (scale varies by i and n)

\[
P_{in} = \frac{\exp[\mu_{in}(Z_{in} | \theta) \cdot V_{in}(X_{in} | \beta)]}{\sum_{j \in C_n} \exp[\mu_{jn}(Z_{jn} | \theta) \cdot V_{jn}(X_{jn} | \beta)]}
\]

See Swait and Adamowicz (2001); Swait (2006) for derivation details and commentary.
Taste Heterogeneity and Scale

- Most analysis that incorporate taste heterogeneity ignore scale heterogeneity (heteroskedasticity).
- This could result in significantly biased estimates of taste (and heterogeneity in tastes).
- However, to combine both requires some structure or identification of the model.
- Examples:
  - Walker and Ben-Akiva 2002 – Generalized RUM (TRR)
  - Hu, Adamowicz and Veeman 2006 – Reference point effects in demand
  - Cameron and Englin 1997 – Experience in CVM (JEEM)
  - Brownstone, Bunch Train 2000 RP and SP in Transport (TRRb)
  - Hanley, Adamowicz, Wright (2005) Price effects (ERE)
Preference versus Scale Heterogeneity

- Preference Heterogeneity versus Scale Heterogeneity
  - Some recent results
    - Meyer and Louviere (2007) – scale component significant (50% of variability)
    - Keane, Louviere, Fiebig and Wasi (reported in Adamowicz et al 2008) – tests on 8 data sets – scale heterogeneity more significant that previously thought.
    - Zhang and Adamowicz (2008): Accounting for preference heterogeneity important, but scale heterogeneity also important (best models arise when both are included)
Train and Weeks WTP Space model:
(See also Scarpa et al 2007 – Application to recreation)

\[ U_{njt} = -\alpha_n p_{njt} + \beta_n x_{njt} + e_{njt} \]

variance of \( e \) is individual specific
divide all terms by the individual specific scale \( k_n \)
\[ U_{njt} = -(\alpha_n / k_n) p_{njt} + (\beta_n / k_n) x_{njt} + \varepsilon_{njt} \]
or
\[ U_{njt} = -\lambda_n p_{njt} + c_n x_{njt} + \varepsilon_{njt} \]

since WTP is \( w_n = \frac{c_n}{\lambda_n} \) one can estimate
\[ U_{njt} = -\lambda_n p_{njt} + \lambda_n w_n x_{njt} + \varepsilon_{njt} \] \( \text{or,} \)
\[ U_{njt} = -\frac{1}{\sigma_n} p_{njt} + \frac{\beta_n}{\sigma_n} x_{njt} + \varepsilon_{njt} \]
the model in WTP-space
The Structure of “V”
What is the structure of the utility function?

- Attributes, demographic components
- Separability assumptions
- Perceptions
  - Heterogeneity in perceptions
- Unobserved attribute effects?
- Endogenous attributes?
- Reference dependence
  - What is the reference point?
  - In revealed preference? In choice experiments?
Endogeneity / Interdependence

- Considerable evidence that factors in recreation demand models are not exogenous
  - Catch rates in recreational fishing
  - Congestion
    - Choice depends on choices / utilities of others
  - Travel cost – endogenous location choice
- Interdependence
  - Congestion is an example of interdependence
  - Group decision – (Dosman and Adamowicz)
  - Peer effects?
Advances in Treating Endogeneity

- Timmins and Murdoch – Congestion
  - Individual maximizes utility subject to expectation over other individuals (interdependence)
  - Nash equilibrium concept used to identify equilibrium (sorting equilibrium)
  - Assess unobserved attributes using Murdoch (2006) approach
  - Reveals substantial differences in welfare measures
  - Allows for assessment of “re-sorting” if exogenous changes occur.

- Boxall, Hauer and Adamowicz – identify congestion component using stated preferences
  - Congestion treated using a type of instrumental variable based on perceptions

- Phaneuf et al – compare econometric and Computable General Equilibrium Models of endogeneity
Time in Models of Choice
Temporal Dimensions

- Most recreation valuation research has been “static”
  - Learning, habits / variety seeking; largely ignored
  - Costa and Hahn (2003) evidence of nonmarket values increases over time – is this true for recreation valuation?
- Most emphasis on opportunity cost of travel time
- Little research in recreation economics literature
  - Literature on Temporal Dimensions: Adamowicz; Provencher and Bishop; Hicks and Schnier; Baerenklau and Provencher;
  - Valuation with time series / panel data
    - Revealing very different outcomes than static models.
What are issues faced with dynamic choice models?

- What varies over time?
  - Systematic utility
    - Tastes
    - Prior states/decisions: state dependence, habits/inertia
    - Expectations
    - Variety-seeking
  - Stochastic utility
    - Temporal variation of variances and co-variances
    - Temporal correlation (e.g. serial correlation)
- Choice set variation
- Decision rule
  - Stability
  - Influences on selection of decision rule (past & present)
- Initial conditions for all of these
Root

Period 1

Period t

Period T

\( \mu \)

\( \mu_i \)

\( \theta_{GF,t} \)

Go Fishing

\( \theta_{SH,t} \)

Stay Home

\( \mu_t \)

\( \mu_T \)

Swait, Adamowicz and van Bueren
Figure 6: Simulations of Probabilities of Choosing Site 2 Under Policy 2 – Site 2 Closure, Weeks 4-7
Temporal Dimensions Summary

- Significant differences between static and dynamic welfare measures
- Suggest that revealed preference data alone cannot be used for some valuation outcomes (e.g. site closures).
- Illustrates the need for time series data on resource use and preferences
- Challenges remain regarding initial conditions, preference evolution, etc.
Context Effects
Context Effects

- habit or experience dependence effects,
- social interdependence,
- accountability effects,
- menu-dependence,
- chooser-dependence,
- framing

- mental accounting,
- choice bracketing,
- motivation effects,
- decoy effects,
- compromise effects,
- reference prices,
- complexity effects,
- missing information

See: Swait et al, 2002
Integrating Economic and Ecological Models
Integrating Demand Data with Biophysical Information / Dynamics

- Using recreation / tourism demand models for policy analysis
- Integration with simulation / optimization models
- Examples
  - Naidoo and Adamowicz
  - Nanang and Hauer
Demand analysis (stated preference, calibration to actual visitation data)
- Used to assess visitation, revenue as a response to change in land use

Spatial map of land values constructed
- Satellite images to model land-use change
- Agricultural rents

Developed measures of the opportunity cost of conservation

Developed estimates of the potential revenues associated with conservation efforts
## Tourism and Avian Biodiversity

<table>
<thead>
<tr>
<th>Features of nature parks</th>
<th>Mabira Forest Reserve</th>
<th>Budongo Forest Reserve</th>
<th>Kibale National Park</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel time from Kampala</td>
<td>1 hour</td>
<td>5 hours</td>
<td>6 hours</td>
</tr>
<tr>
<td>Entrance fee (U.S. $)</td>
<td>10</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Destination part of tour?</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Lodging facilities</td>
<td>Cabin</td>
<td>Tent</td>
<td>Luxury lodge</td>
</tr>
<tr>
<td>Landscape features</td>
<td>Primary forest</td>
<td>Primary forest</td>
<td>Seconday forest</td>
</tr>
<tr>
<td>Bird species you may see</td>
<td>60</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>Chance of seeing large wildlife</td>
<td>Very slim chance</td>
<td>Very slim chance</td>
<td>Very good chance</td>
</tr>
</tbody>
</table>

I WOULD NOT VISIT ANY OF THESE PROTECTED AREAS ON MY NEXT TRIP
Fig. 1. Land rents for Mabira Forest Reserve in 2001. Rents have been converted to U.S. dollars. Darker areas indicate higher land rents, which are mostly in the western part of the reserve. Areas in red were deforested between 1986 and 2001. The local road network is also shown, as well as a 2001 Landsat image of the surrounding agricultural landscape. Areas in gray were deforested before 1986 and are now regenerating.

Source: Naidoo and Adamowicz
Source: Naidoo and Adamowicz
Summary

- One example of simulation
  - Measurement of the opportunity costs of conservation and the potential benefits of conservation

- Weaknesses
  - Processes for costs and benefits are “decoupled”
  - No interactions between revenue assessment and opportunity costs

- Incorporate utility for recreationists as a component of a large scale forestry optimization model
  - Maximize revenues from forestry (spatial) and “revenues” from recreationists
  - Examined unconstrained models as well as models that provide at least a certain level of welfare to recreationists
- Landscape characteristics affect recreationists, solution patterns change significantly when recreation taken into account.
Spatial location of harvesting of forests

Top: No constraint on recreation value

Bottom: Minimum requirement for recreation value

Source: Nanang and Hauer 2008 P 147.
Spatial location of recreation activities

Top: No constraint on recreation value

Bottom: Minimum requirement for recreation value

Conclusions

Recreation / Tourism is a sector that highlights interactions between human behaviour and the natural environment.

- As such – it provides a key pathway to assess the value of ecosystem goods and services.
- It provides a mechanism for capturing the value of environmental improvements.

However, it is a complex set of behaviours, characterized by spatial, temporal, interdependent (endogenous) decisions.
Which way to go?

- Modeling behavior
- Where might the most significant payoffs from research be?
  - Data
    - Revealed Preference and Stated Preference Data
    - Quasi-experiments?
  - Temporal dimensions
    - Learning, information transmission, habits, etc.
    - Value of time
      - On-site time (Landry and McConnell, 2007)
    - Temporal welfare measures
- Choice sets
  - Fundamental to all micro-level choice analyses (recreation, marketing, transportation, etc)
Which way to go?

- Integration of demand models with bio-physical models
  - Accounting for endogeneity (and other components of economic behaviour) as well as environmental change
  - Microsimulation? Agent Based Models? CGE?
- Recreation trends
  - Linking the trends in time-use and recreation behaviour into micro-econometric analysis.
References


Andrew Balmford*, James Beresford1, Jonathan Green1, Robin Naidoo2, Matt Walpole3, and Andrea Manica1 Rumours of nature recreation’s death exaggerated? Manuscript.


LaMondia, J. C. Bhat and D. Hensher. 2007. An annual time use model for domestic vacation travel. Working paper, University of Texas at Austin.


Murdoch, J. 2006. Handling unobserved site characteristics in random utility models of recreation demand. Journal of Env. Econ. and Mgmt. 51: 1–25


