

Choice Experiments and the
Social Value of Forests
Forestry Commission woodlands in
South East England

Anna Manukyants

University of Brighton

Prof. Andrew Church

Dr Neil Ravenscroft

Dr Niall Burnside

Forest Research

Dr Liz O'Brien

Paul Tabbush

January 2005

Outline

☞ Background

☞ Research aim

☞ Theoretical framework

☞ Empirical study

- Stage 1. Site selection
- Stage 2. Value dimension specification
- Main stage: Postal CE survey

☞ Survey findings

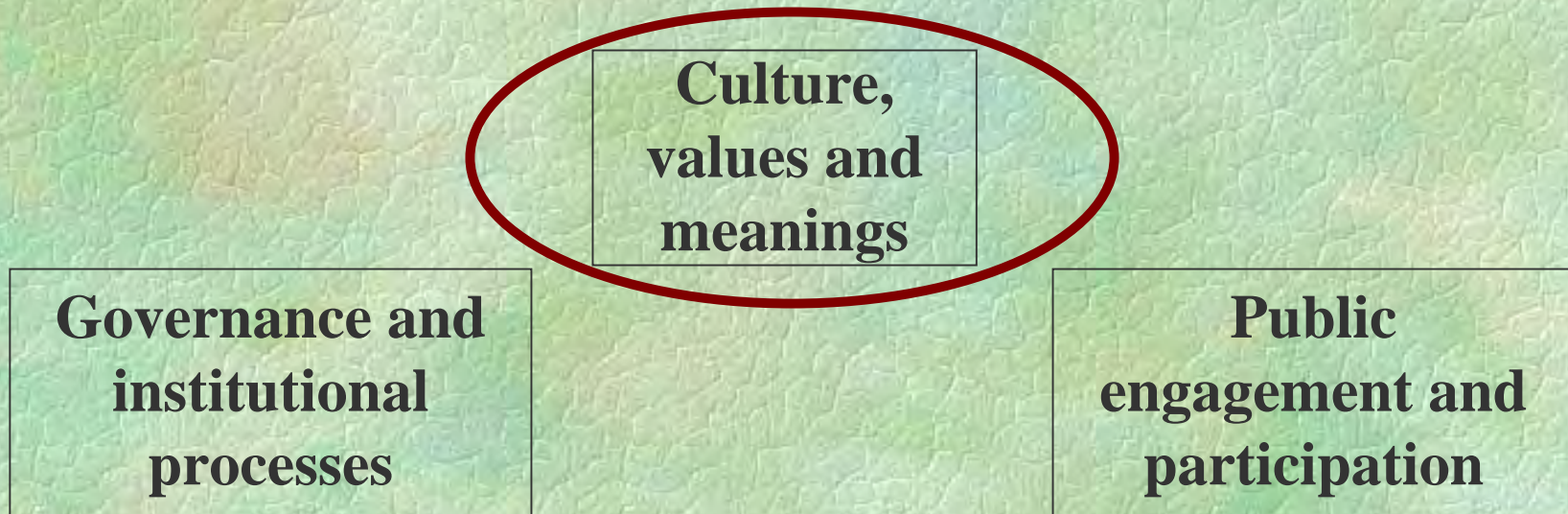
☞ Conclusion

Background

☛ SFM, the New Forestry Paradigm

- Increased research into 'Environment and Quality of life' (FC corporate plan 2001-2004)

☛ Social Forestry Research



O'Brien and Claridge (eds.) 2002

Multi-dimensional forest values

☞ Non-market benefits (NMBs)

- recreation
- landscape and amenity
- biodiversity conservation
- environmental services (carbon sequestration)
- human health and well-being
- historic, cultural, symbolic meaning

(Willis et al. 2000)

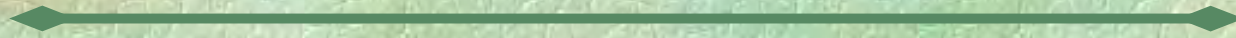
☞ Diversity of personal woodland experiences/values

- contact with nature / moral uplift / family day out...

☞ Woodlands in wider local and national contexts

- sense of ownership / community involvement / local identity...

How to capture the social values of forests in ways appropriate for inclusion in forestry planning and management decision making?



Research aim

- Generating and applying a Choice Experiment postal survey in a FC woodland in South East England

Outcome



- A better understanding of people's preferences and values of forests;
- A way to incorporate the findings into forestry planning and decision making processes.

Theoretical framework: EV

☛ Environmental valuation (EV) framework

- Neo-classical economics and cost-benefit analysis (CBA) paradigm
- Non-market benefits and willingness-to-pay (WTP) mechanism
- Contingent Valuation Method (CVM)

☛ Debates and challenges

- Economic conceptualisation of value
- Underlying utility theory
- WTP estimation: CVM method

Some of the major criticisms of CVM

- ☛ the hypothetical nature of the approach;
- ☛ a number of respondents' biases
- ☛ information provision issues and respondents' understanding of the environmental problem being valued;
- ☛ divergences in interpretation of results.

(Turner et al. 1994; Bowers 1997)

**Alternative
valuation
approaches**



Advantages of CE over CVM

- ☞ environmental valuation is not necessarily made in money terms;
- ☞ some respondents' biases (such as strategic behaviour) can be alleviated;
- ☞ description of attributes vs. description of environmental situation as a whole.

- ☞ More research is required

Theoretical framework of CE: RUT

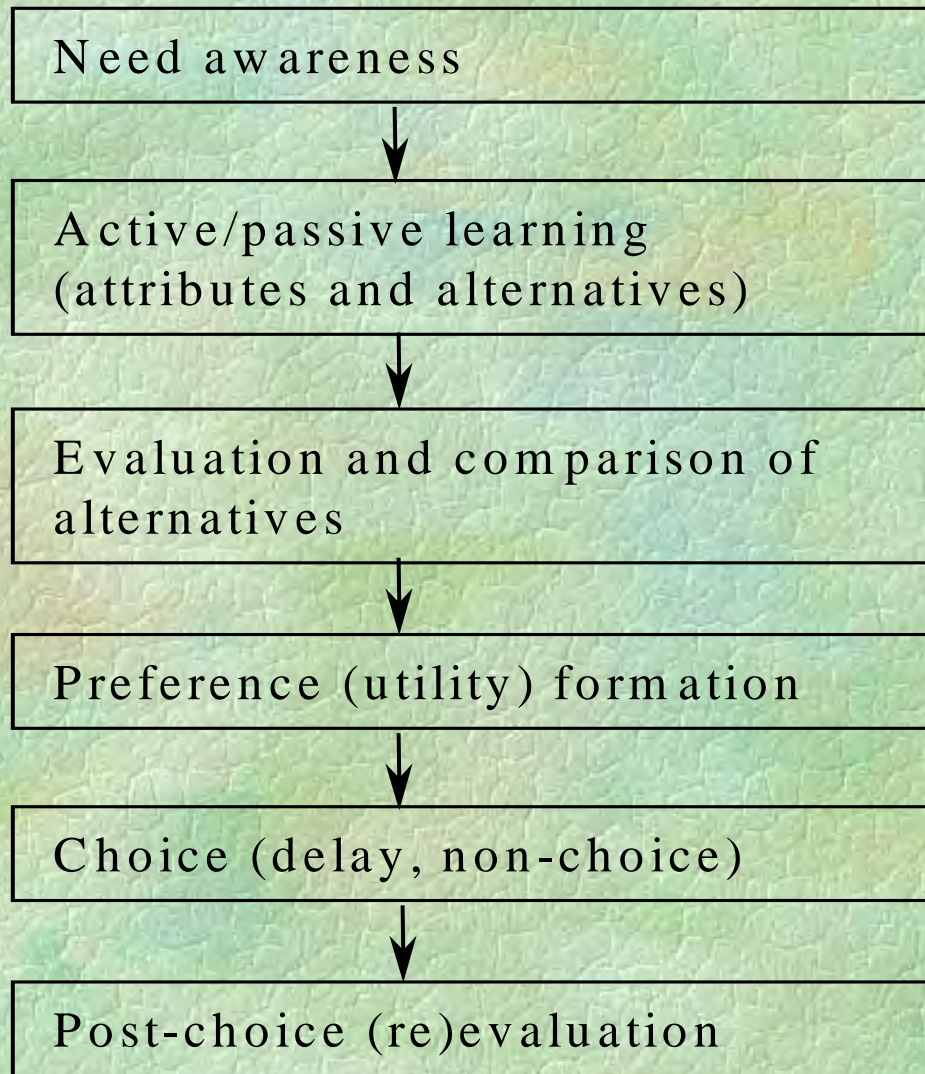
☞ Originates from:

- marketing / consumer research
- cognitive psychology

☞ Underlying paradigm - Lancaster-Rosen model:

- utility of a good is derived from its properties not the good per se
- consumer choice model

Consumer choice process



(Louviere et al. 2000)

Choice process formalised

☞ **Utility function:**

- $U_{ij} = f(V_{ij}, e_{ij})$

☞ **Probability of choice:**

- $P_{ih} = \text{Prob} (V_{ih} + e_{ih} > V_{ij} + e_{ij})$ for all (j) in X and $h \neq j$

Random Utility Theory (RUT)

☞ **Multinomial (conditional) Logit (MNL) model**

$$P_{ih} = \frac{\exp[\mu V_{ih}]}{\sum_{j \in X} \exp[\mu V_{ij}]} \quad / \quad V_{ij} = ASC_j + \sum_{a=1}^n \beta_a X_a + \sum_{a=1}^m \gamma_a (S_a \cdot ASC_j)$$

Methodological considerations

- ☛ Choice of model: MNL and IIA assumption
- ☛ Purpose of analysis: relevant importances, market shares
- ☛ Accounting for heterogeneity: Gumbel scaling
- ☛ Accounting for choice consistency: 2 order versions

Experimental study: preparatory research

☞ Stage 1. Site Selection:

- Recreational preferences
- GIS-based analysis of FC woodlands in SE England
- Selected sites: Friston Forest and Abbot's Wood

☞ Stage 2. Identification of forest value dimension

- Visitor questionnaire
- Importance rating of 31 woodland related characteristics
- Specification of forest value dimensions

Experimental study: postal CE survey

Design procedure

- ☞ Target population and sample size
- ☞ Questionnaire design
 - Attributes and levels
 - Alternatives and choice tasks
 - Wording and presentation

Consultation /
Testing and piloting

Attributes and levels

☞ Nature Conservation

- 10% of woodland area
- 20% of woodland area
- 30% of woodland area
- 40% of woodland area

☞ Facilities for Access

- Basic (footpaths, car park)
- Low (+ picnic areas, toilet)
- Medium (+cycle tracks, children playgrounds)
- High (+visitor centre, horse-riding, orienteering)

☞ Experience of Nature

- Knowledge (no actual visits)
- Casual (informal activities)
- Planned (family days out, several activities)
- Working with people (day-to-day management)

☞ Distance

- Reachable within 15 min
- 15-30 min
- 30-45 min
- Over 45 min

Each possible combination of attribute levels represents an **alternative (or option)**

Alternatives: status quo

Existing situation: Friston Forest and Abbot's Wood

Woodland conservation area with only public rights of way access

10%



Facilities for public access

High



Woodland use to experience nature






Planned



Woodland location relative to your place of residence

Reachable within 15 min

Choice tasks: 16 for each respondent

	Option A	Option B
Woodland conservation area with only public rights of way access	10% 	40% 
Facilities for public access	Basic 	High 
Woodland use to experience nature	Knowledge 	Working /volunteer activities 
Woodland location relative to your place of residence	Reachable within 15 minutes	Over 45 minutes away

Which option would you choose? **A** **B** **none**

CE survey results

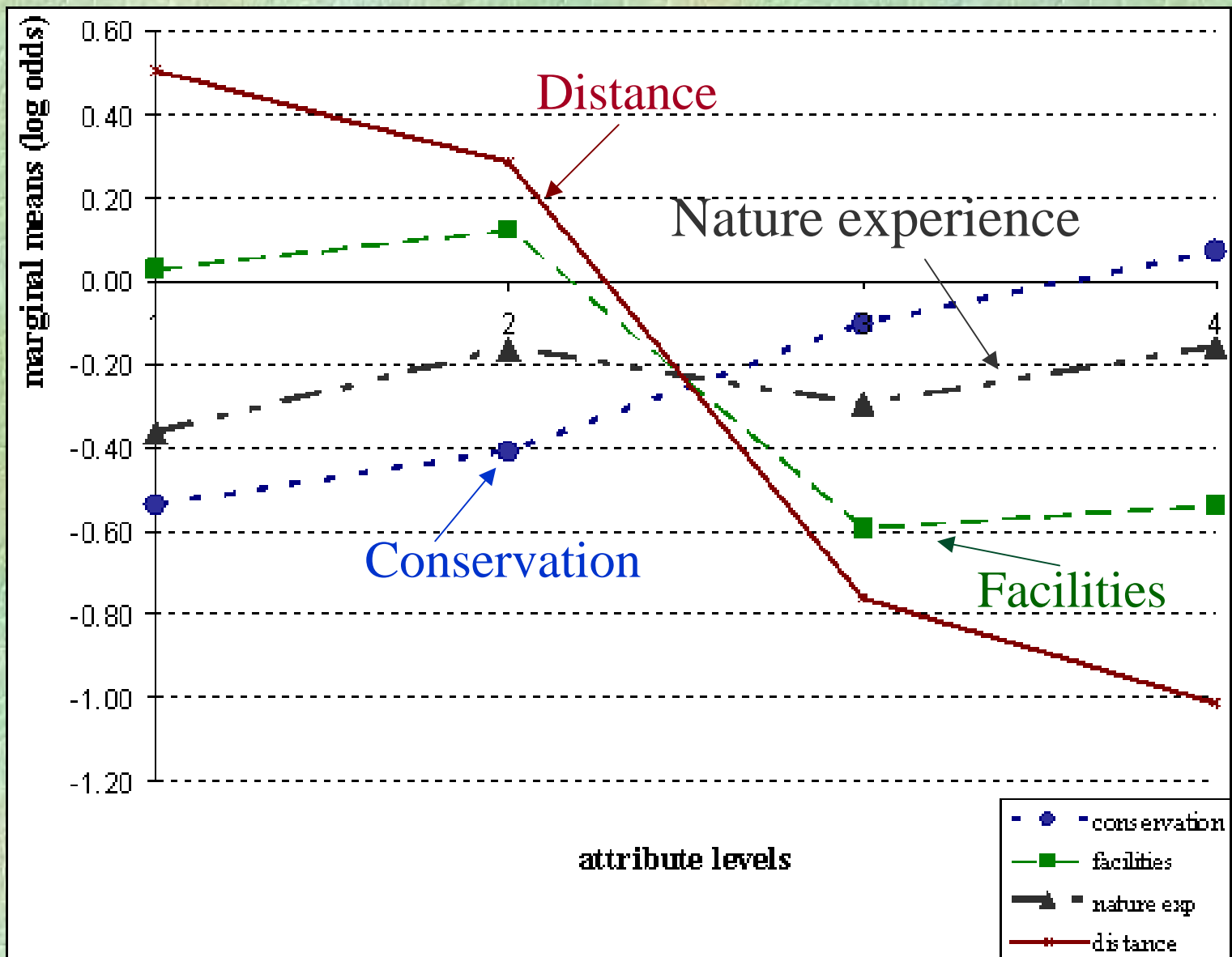
- ☛ Response statistics
- ☛ Sample socio-demographic profile
- ☛ Forest use and attitudinal profile
- ☛ Choice data analysis

Choice data analysis: Base model

(Sub-)sample size (n)	Base model (1)			
	241			
	parameter estimate	p-value	range	relative importance
Constant	1.12	0.00		2.62
Nature conservation				
<i>c10 (status quo)</i>	-0.14			-0.33
c20	-0.13	0.02		-0.29
c30	0.06	0.26		0.14
c40	0.21	0.00	0.35	0.48
Facilities for access				
rbasic	0.12	0.03		0.27
r _{low}	0.24	0.00		0.57
r _{med}	-0.14	0.01		-0.33
<i>r_{high} (status quo)</i>	-0.22		0.46	-0.51
Experience of nature				
nknow	-0.08	0.18		-0.18
ncas	0.06	0.28		0.14
<i>nplan (status quo)</i>	0.00			-0.01
nwork	0.02	0.74	0.13	0.04
Distance				
<i>d0 (status quo)</i>	0.43			1.00
d15	0.29	0.00		0.67
d30	-0.29	0.00		-0.68
d45	-0.43	0.00	0.85	-0.99

McFadden's
RhoSq – 16%

Marginal utility means (log odds) of 4 attributes



Choice data analysis: sub-samples and Gumbel scaling

☞ Socio-demographic and forest use variables

- Gender;
- Place of residence: urban versus rural;
- Age group: 18-55 years old versus over 55 years old;
- Household size: 2 or less persons versus 3 or more persons;
- Frequency of forest visits: frequently (at least monthly) versus infrequently;
- Number of activities undertaken during visit: 2 or less activities versus 3 or more activities;

☞ Choice task order effect

CE survey findings: understanding preferences

☞ Contribution of individual attributes

- Nature conservation versus provision of facilities for access
- Experience of nature

☞ Different Publics

☞ Best scenario

CE survey findings: methodological issues

☞ Data analysis and validity

- Sign and direction confirm to a priori expectations
- Goodness-of-fit statistics
- Prediction success

☞ Design and implementation

- Confusion and complexity
- Stability of preferences

Recommendations and further research

☞ Implications for forest planning and management

- CE gaining popularity
- Non-monetary estimation of part-worth utilities
- Capturing diversity of preferences
- Rigour in design and implementation to ensure minimisation in inconsistency in choices and cognitive burden

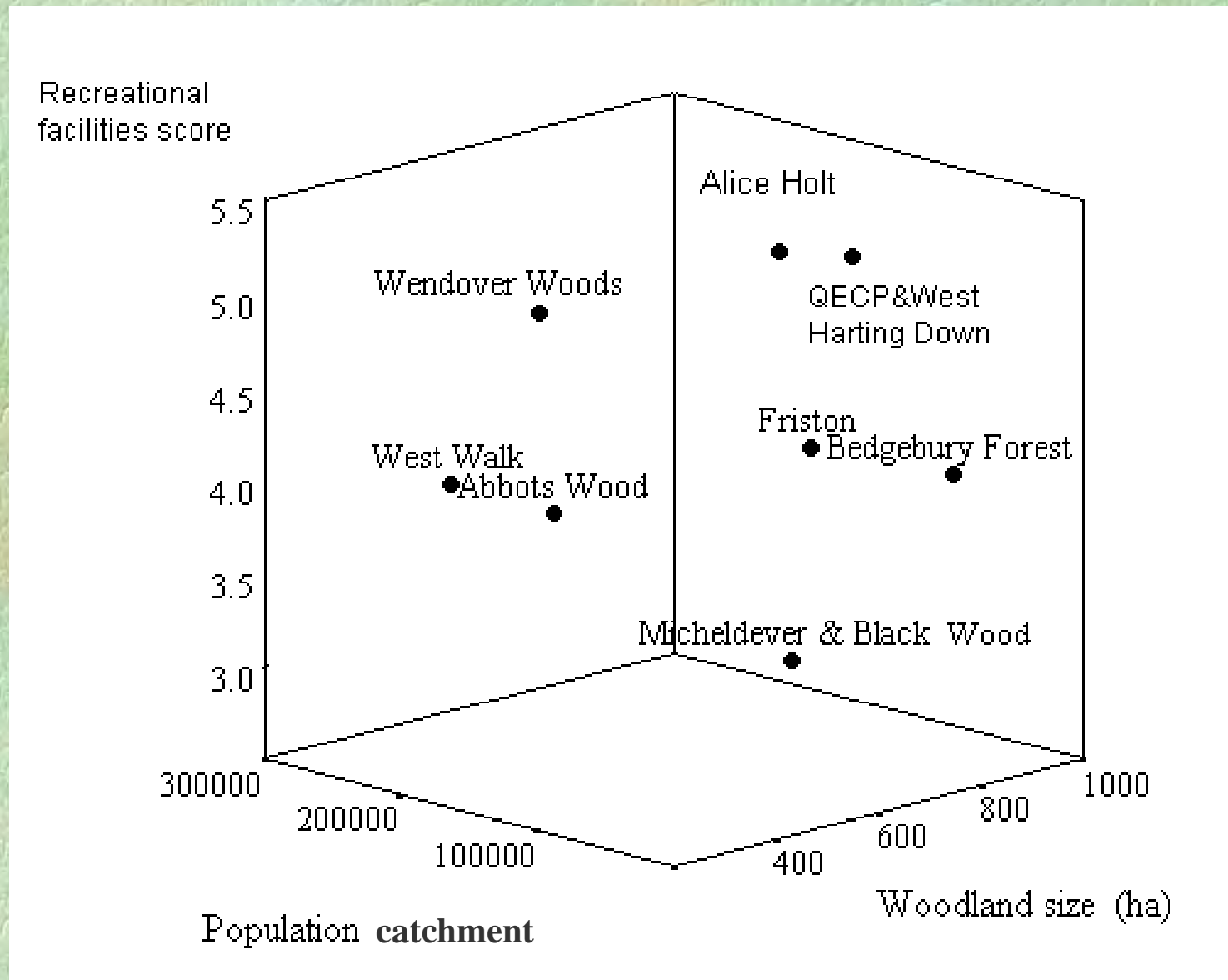
☞ Further research

- Data analysis and advancing statistical modelling
- Follow-up
- CE and preference construction

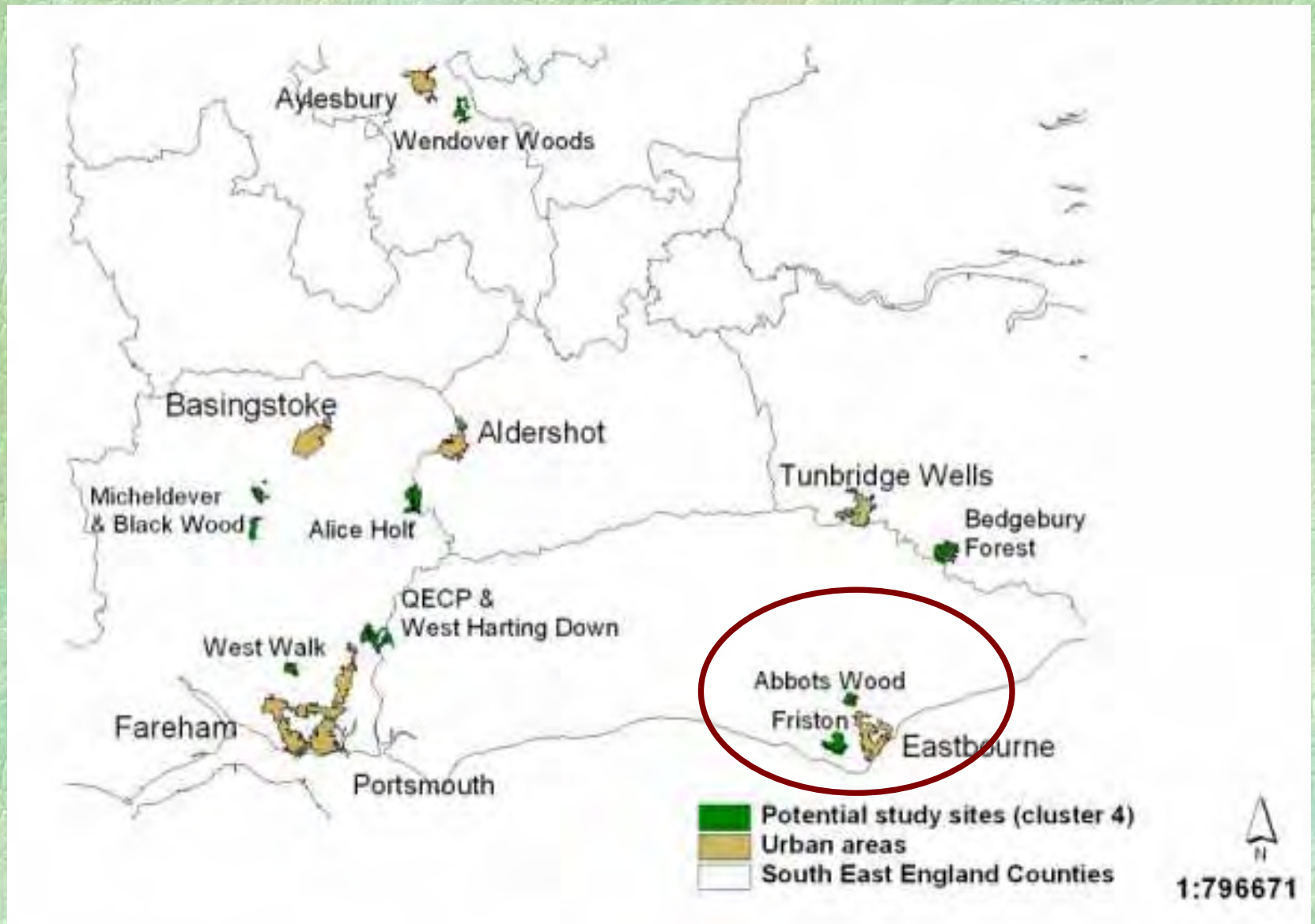
A misty forest scene with tall, slender trees in the background. In the foreground, a bush of vibrant red autumn leaves is prominent. The overall atmosphere is soft and ethereal due to the mist.

Thank you.

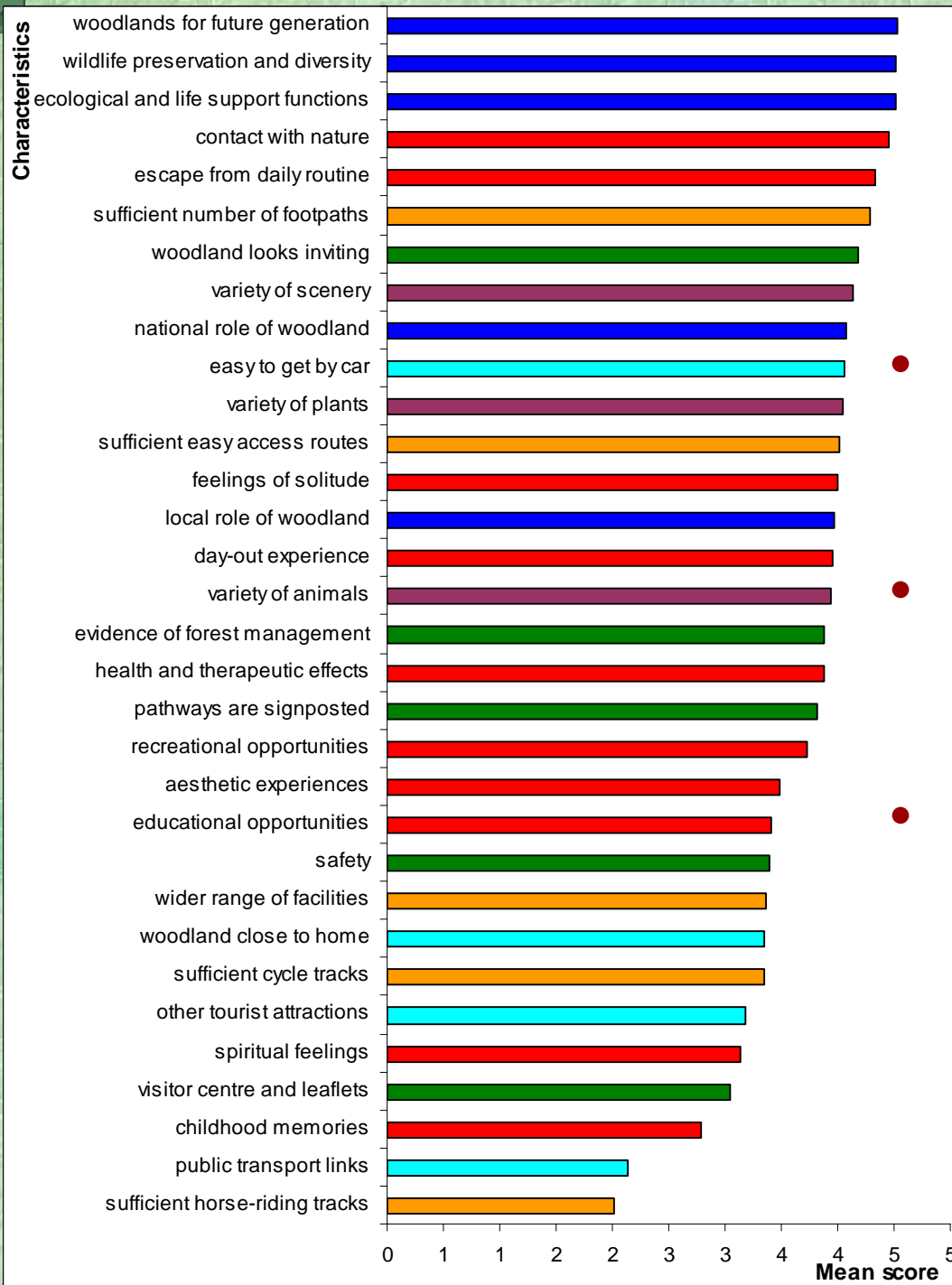
Scatter plot of woodlands in cluster 4 by 3 variables



Selected sites: Frison Forest and Abbot's Wood



Specification of forest value dimensions

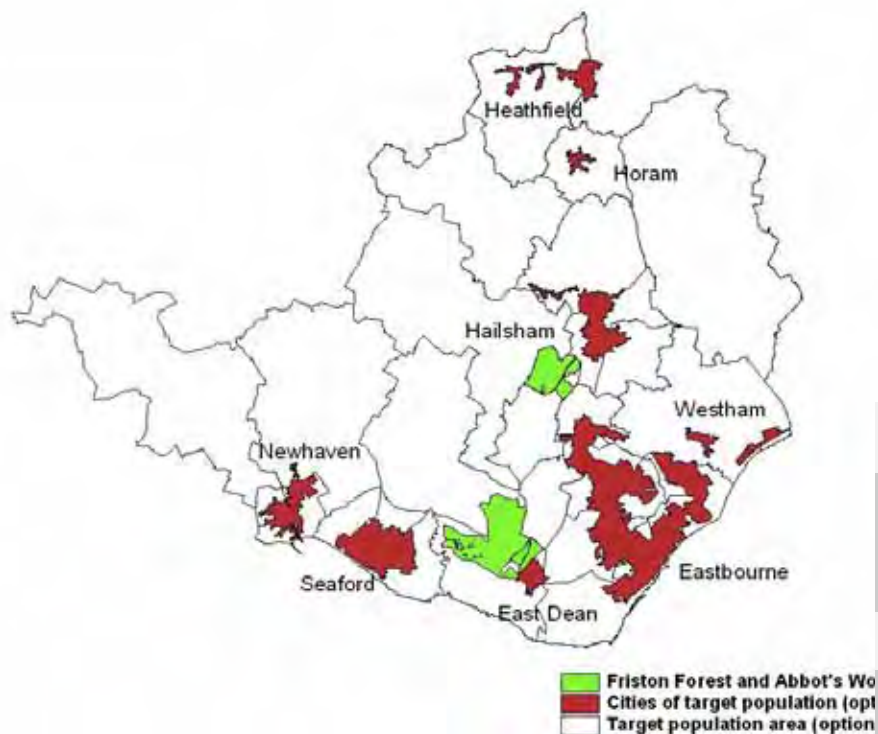


- **Nature conservation**

- **Experience of nature**

- **Provision of facilities for access**

Target population - local residents



Sample frame

Parishes	Ward	Population
Cuckmere Valley East Dean and Friston Long Man	East Dean	1439
Arlington	Hellingly	319
Hailsham South and West	Hailsham (South and West)	5002
Polegate North	Polegate North	3109
Polegate South	Polegate South	1474
Polegate Watermill Ward Willingdon and Jevington	Willingdon	4700
Sample frame		16043

Sample size

- 919 rural
- 803 urban

Response statistics

Number of questionnaires sent out		Number of questionnaires received			CE data (part 2)		
Total	1722	Total	378	%	Total	327	%
Version 1 (rural subsample)	459	answers to part 1	346	92	complete	296	91
Version 1 (urban subsample)	401	answers to part 2	327	87	incomplete	31	9
Version 2 (rural subsample)	460	answers to part 3	334	88			
Version 2 (urban subsample)	402	comments only	32	8			

• **Response rate: 22%**

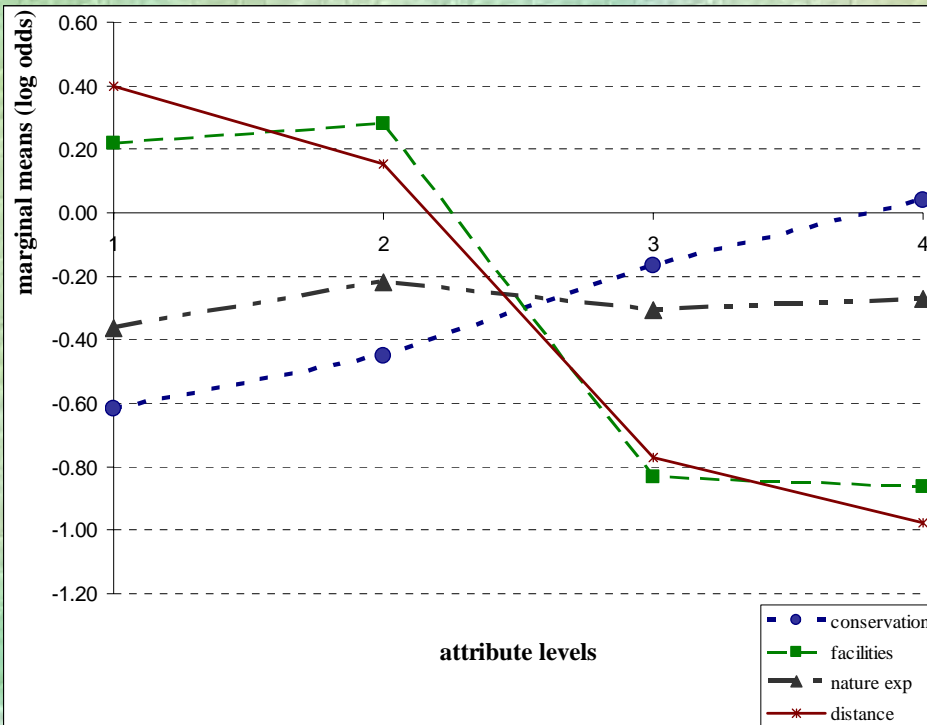
• **CE usable questionnaires: 296**

Choice data analysis by Count

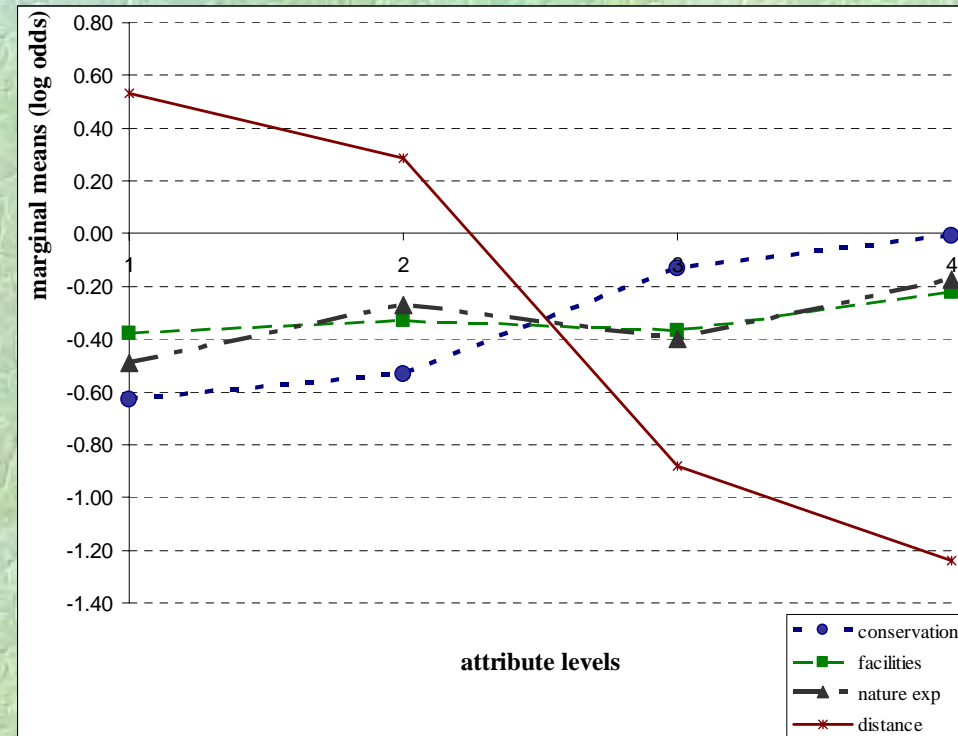
- ☛ Number of times each alternative appears (b)
- ☛ Number of times each alternative is chosen (a)
- ☛ Odds of choice ($a/(b-a)$) and transformation to log-odds
- ☛ Calculation of the average of log-odds for each attribute level (mean effects)

Comparison of 2 sub-samples by age group

Over 54 years old group



18-54 years old group



Model estimations for 2 sub-samples by age group

(Sub-)sample size (n)	Over 55 years old (4.1) 142				18-54 years old (4.2) 99			
	parameter estimate	p-value	range (max. min)	relative importance	parameter estimate	p-value	range (max. min)	relative importance
Constant	1.15	0.00		2.64	1.06	0.00		2.39
Nature conservation								
<i>c10 (status quo)</i>	-0.16			-0.36	-0.15			-0.33
c20	-0.11	0.13		-0.26	-0.14	0.11		-0.31
c30	0.05	0.52		0.11	0.09	0.29		0.20
c40	0.22	0.00	0.38	0.51	0.20	0.02	0.34	0.44
Facilities for access								
rbasic	0.20	0.00		0.46	-0.02	0.83		-0.04
r _{low}	0.43	0.00		0.98	-0.01	0.90		-0.02
r _{med}	-0.20	0.01		-0.46	-0.04	0.62		-0.10
<i>r_{high} (status quo)</i>	-0.43		0.85	-0.98	0.07		0.11	0.16
Experience of nature								
nknow	-0.03	0.67		-0.07	-0.11	0.19		-0.26
ncas	0.05	0.50		0.11	0.06	0.49		0.13
<i>n_{plan} (status quo)</i>	-0.02			-0.05	0.00	0.53		0.01
nwork	0.00	0.95	0.08	0.01	0.05		0.17	0.12
Distance								
<i>d0 (status quo)</i>	0.44			1.00	0.44			1.00
d15	0.22	0.00		0.50	0.39	0.00		0.89
d30	-0.32	0.00		-0.73	-0.27	0.00		-0.61
d45	-0.34	0.00	0.77	-0.78	-0.57	0.00	1.01	-1.27

Comparison of 3 sub-samples

Sub-group (N)	Attribute	Level coefficient range	Contribution to overall utility (%)
Over 55 years old (142)	Conservation	0.38	18
	Recreation	0.85	41
	Nature experience	0.08	4
	Distance	0.77	37
	Total		100
One or two person household (176)	Conservation	0.47	25
	Recreation	0.49	26
	Nature experience	0.15	8
	Distance	0.74	40
	Total		100
Two or less activities (145)	Conservation	0.43	21
	Recreation	0.8	38
	Nature experience	0.08	4
	Distance	0.77	37
	Total		100

Best scenario and market shares

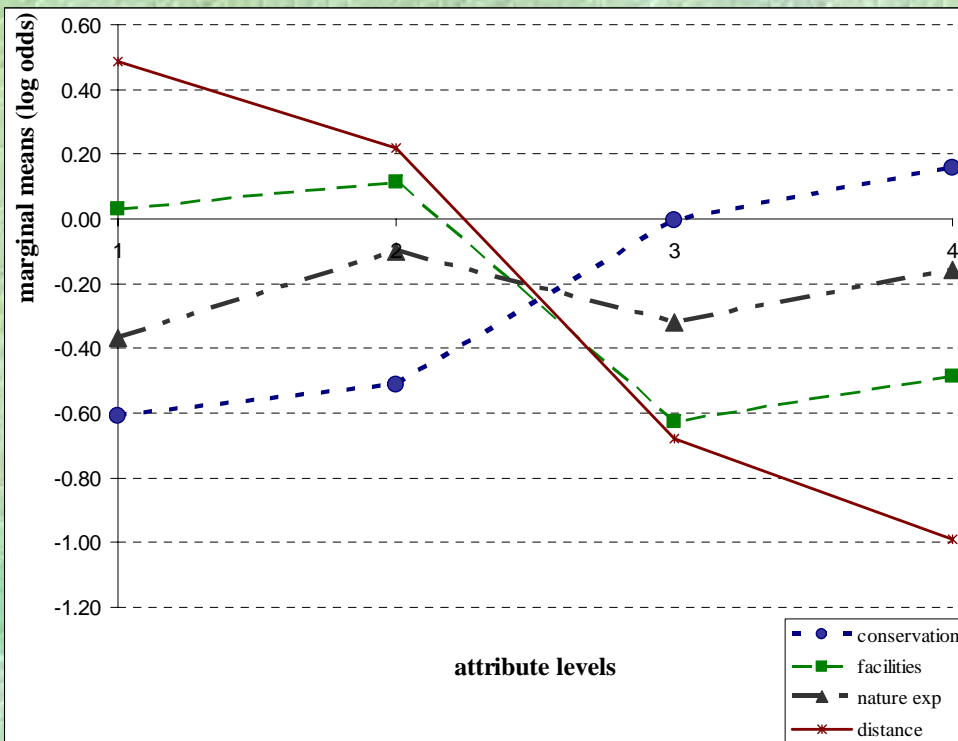
$$\begin{aligned} V_i = & 1.12 - \overbrace{0.14c_{10} - 0.13c_{20} + 0.06c_{30} + 0.21c_{40}}^{\text{levels of the } \textit{Conservation} \text{ attribute}} \\ & + \overbrace{0.12r_{\text{basic}} + 0.24 r_{\text{low}} - 0.14r_{\text{med}} - 0.22r_{\text{high}}}^{\text{levels of the } \textit{Facilities for access} \text{ attribute}} \\ & - \overbrace{0.08n_{\text{know}} + 0.06n_{\text{cas}} + 0n_{\text{plan}} + 0.02n_{\text{work}}}^{\text{levels of the } \textit{Experience of nature} \text{ attribute}} \\ & + \overbrace{0.43d_0 + 0.29d_{15} - 0.29d_{30} - 0.43d_{45}}^{\text{levels of the } \textit{Distance} \text{ attribute}} \\ = & 2.06 - \text{the “best scenario”} \end{aligned}$$

If only two options are presented in a hypothetical choice task: the “best” option and “none”

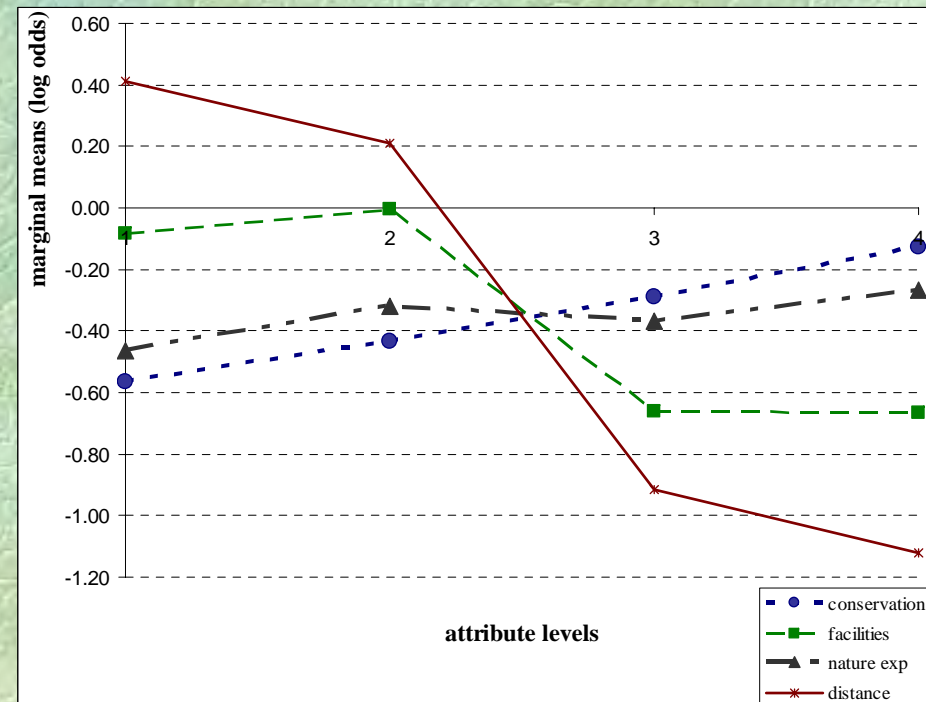
➡ Market share (‘best’) = $[e^{2.06}/(1+e^{2.06})] * 100 = 89\%$

Stability of choices: choice task order effect

Straight choice task order



Reverse choice task order



Research questions refined

- ☞ What information is it possible to obtain via non-monetary estimation of trade-offs in a CE study that could be useful to forest planning and management?
- ☞ What is the potential practical role of the CE methodology in forest planning and management?

Integrative Innovative Approaches

**Survey-based
individual
preferences**

**Environmental
Valuation**

**In-depth
qualitative
methodologies**

**Deliberative
participatory
techniques**