



Using a latent class model to segment preferences of residents for a recreational setting: a case of Golovec urban forest in Ljubljana, Slovenia

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Content of the presentation

Motivation

- heterogeneity of people's demand towards forests within the system of forest management planning

Case of urban forest Golovec

- Design of the study
- The survey
- Analysis of response data and results of the choice experiment

Implications for forest management planning

- Distinct groups of users and segmented preferences
- Optimal management scenarios



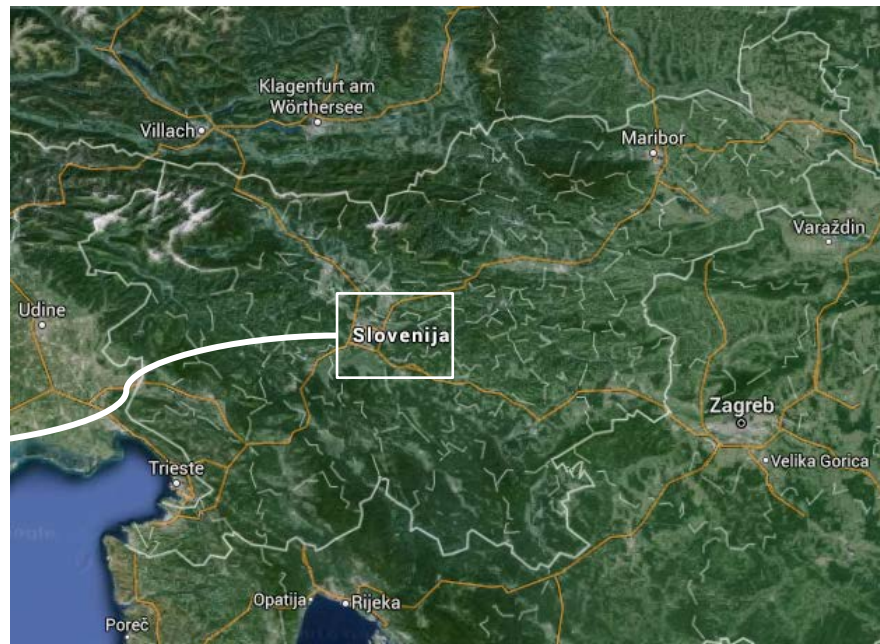
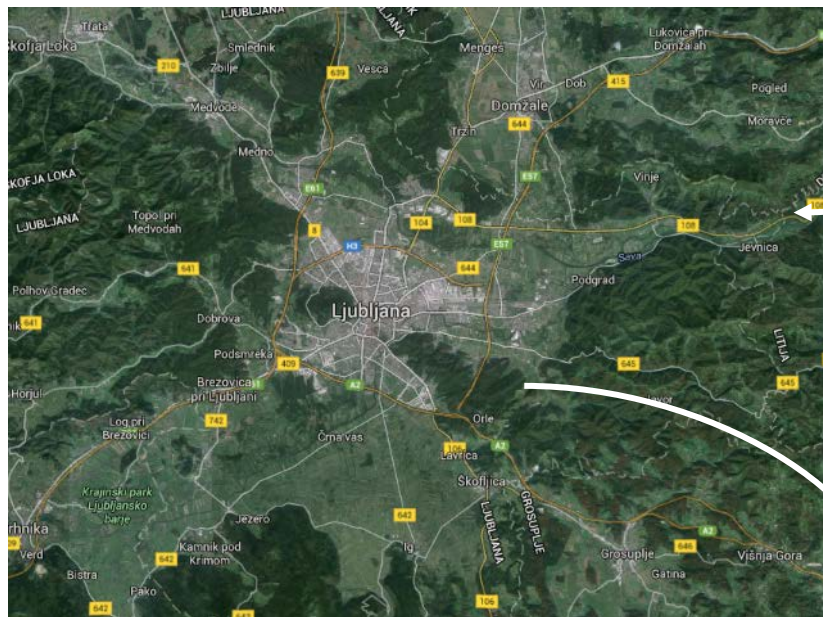
Motivation

„different people see the forest differently“

- Diversity of society's needs for recreation
- FM in Slovenia
 - supply vs. demand of forest goods and services
 - (non)participatory process: officials know what we need
- Our life insurance, our natural capital: EU2020



Case-study area



A = 675 ha
≥75% private
Municipal decree



Study design

- Discrete choice method

„people value ES as bundles of characteristics“

- Attributes and their levels (pre-survey, Delphi)
- Status-quo: field survey

Attribute	Definition	Levels
Outstanding trees	Percentage of outstanding trees among all trees in a 20 m wide strip on either side of a walking trail	<u>6</u> , 12, 18
Forest clearings	Percentage of forest clearings in overall forest area in a 20 m wide strip on either side of a walking trail	<u>0.5</u> , 2.0, 3.5
Waymarks	Either waymarks along walking trails are maintained or not	<u>Not</u> , Yes
Information boards	Either information boards along walking trails are maintained or not	<u>Not</u> , Yes
Paved walking trails	Length of maintained paved walking trails in km	<u>14</u> , 21, 28
Payment	Yearly personal contribution in EUR	<u>0</u> , 2, 4, 6, 8, 10, 12
	<u>Business-as-usual</u> (current state which was defined by field inventory)	



Study design

- Sequential fractional factorial design
 - 9 sequential choices among three alternatives
 - 1 BAU and 2 improving BAU

Which is your favourite alternative.

	No additional measures Current state	With additional measures Alternative A	With additional measures Alternative B
Your annual payment	0 €	2 €	4 €
Outstanding trees	 6%	 6%	 18%
Forest clearings	 0.5%	 0.5%	 2%
Maintenance of waymarks and information boards	 None	 Waymarks	 Info-boards
Paved walking/cycling trails	 14 km	 21 km	 21 km
Please mark your pick	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



The survey

- Actual survey in August of 2013
 - 263 completed questionnaires within the Municipality of Ljubljana
 - 59% CAWI and 41% CAPI by a polling agency
 - 5.7% of protests and 26.6% of biased answers
 - protests: refuses to pay, disagrees with the proposed programme, etc.
 - biased: does not believe in the reality of implementation, warm-glow effect, yeah-saying, etc.
 - 178 valid responses; 1602 observations



Analysis of the response data

- Latent Class Model

- Maximum utility modelled with a theoretical frame of RUM:

$$U_{jit|c} = \beta'_c * x_{jit} + \varepsilon_{jit}$$

- Individual's i class c specific choice j probability in choice situation t :

$$P(y_{it} = j) = E_c \left[\frac{\exp(\beta'_c x_{jit})}{\sum_{j=1}^{J_i} \exp(\beta'_c x_{jit})} \right]$$
$$= \sum_{c=1}^C P(\text{class} = c) = \left[\frac{\exp(\beta'_c x_{jit})}{\sum_{j=1}^{J_i} \exp(\beta'_c x_{jit})} \right]$$



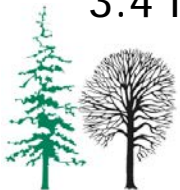
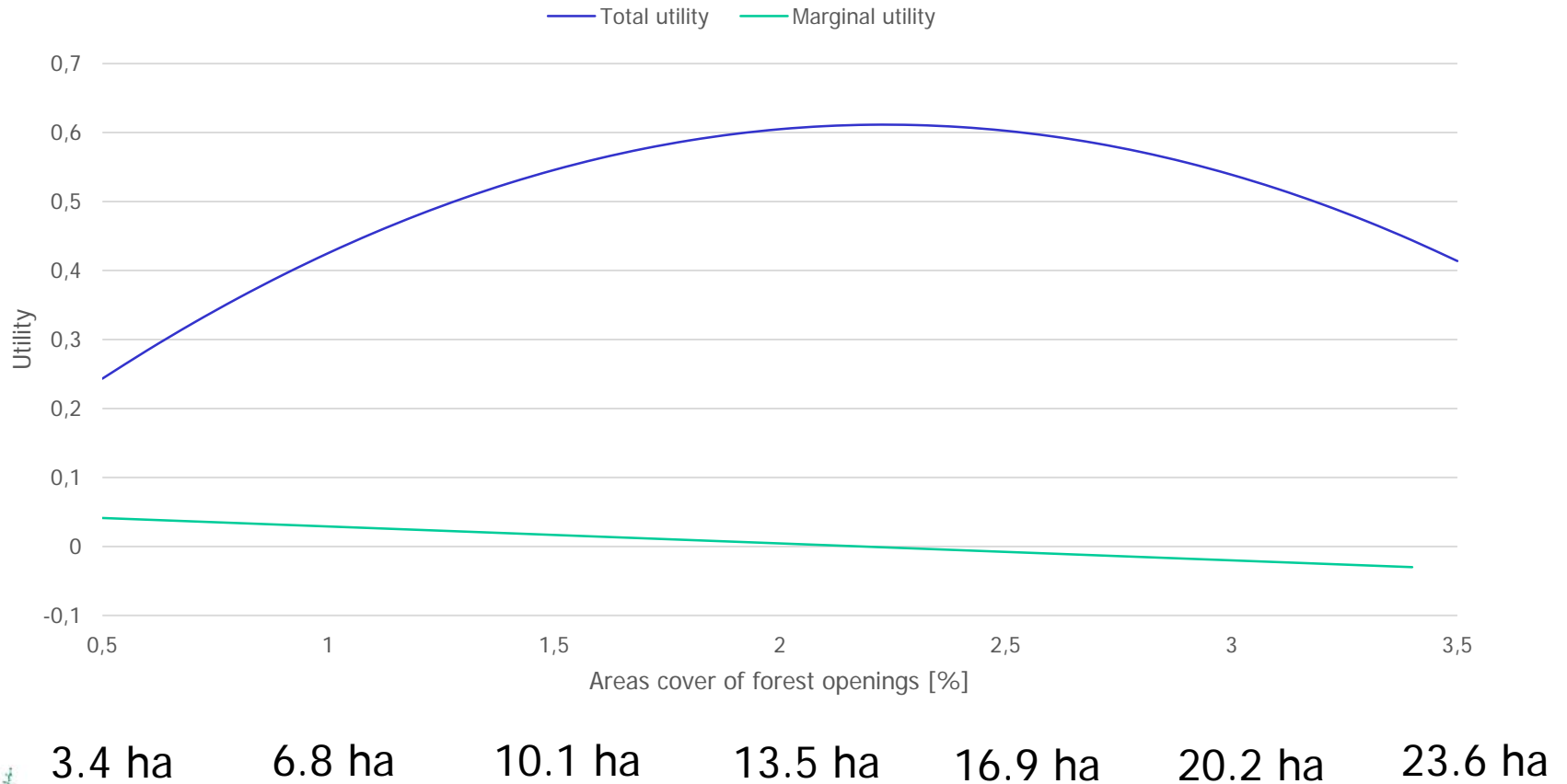
Results of the choice experiment

- Model estimation of the utility-f. parameters

Attributes	Estimates of the utility function parameters	
	Class 1 (rejecters) [share of respondents: 49 %]	Class 2 (supporters) [share of respondents: 51 %]
	$\hat{\beta}$	$\hat{\beta}$
Outstanding trees	0.17*	-0.00
Forest openings	1.07	0.55**
Forest openings ²	-0.29	-0.12**
Waymarks	-0.45	0.32*
Information boards	-0.16	0.40***
Paved trails	-0.15*	0.01
Yearly payment	-0.85***	-0.14***
Constant term	0.30	2.00***
	Estimates of the membership function parameters	
	Class 1	Class 2: reference class
Additional variables	θ'	
Constant term	1.28	Model diagnostics
Age	0.04**	logL = -1007.15
Settlement type (1-city;0-rural)	-1.00*	No. of observations = 1602
Frequency of visiting a forest	-0.29**	pseudo- $R^2 = 0.43$
Walking a dog (1-no;0-yes)	-0.31*	*p=0.10; **p=0.05;
Picking forest fruits (1-yes;0-no)	-0.68*	***p=0.01



Results of the choice experiment



Results of the choice experiment

- Willingness-to-pay for the attribute changes

Attributes	Mean yearly willingness-to-pay per person [EUR]	
	Class 1 (rejecters) [share of respondents: 49 %]	Class 2 (supporters) [share of respondents: 51 %]
Outstanding trees	0.20** [0.01; 0.38]	-0.00 [-0.17; 0.16]
Forest openings	0.16–1.15	1.76–4.43**
Waymarks	-0.56 [-1.97; 0.86]	2.32** [0.13; 4.51]
Information boards	-0.19 [-1.79; 1.40]	2.93*** [0.96; 4.91]
Paved trails	-0.17* [-0.35; 0.00]	0.07 [-0.06; 0.21]
* p=0.10; **p=0.05; *** p=0.01		



Results of welfare analysis

Attributes			Total consumer surplus [EUR/year]			
			Forest openings			
			0.5 %	2.0 %	2.3 %	3.5 %
<u>Scenario: silviculture</u>	Outstanding trees	6 %	0	271 372	276 335	113 157
		12 %	131 699	403 071	408 034	244 856
		18 %	263 399	534 770	<u>539 734</u>	376 555
<u>Scenario: infrastructure</u>			Information boards – no maintenance			
			Waymarks			
			No maintenance		Maintenance	
	Paved trails	14 km	0		265.011	
		21 km	-130 602		134 409	
		28 km	-261 204		3 808	
			Information boards – maintenance			
			Waymarks			
			No maintenance		Maintenance	
	Paved trails	14 km	334 691		<u>599 702</u>	
21 km		204 089		469 101		
28 km		73 487		338 499		



Implications for forest management planning

- Heterogeneity of preferences
 - Two distinct segments of people: change rejecters and change supporters
- The optimal management scenario
 - Silviculture: 18% of outstanding trees, 2.3% of forest openings (15 ha)
 - Infrastructure: maintained waymarks and information boards, 14km of paved trails (no change)



Future challenges

- Making the information spatially-explicit: enables zoning of the recreation area
- Increasing the representativeness of forest owners
- Employing models, which explain taste variation in more detail: random parameter latent class logit model



Thank you!

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