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Do preferences for native bee conservation measures change after a pollination crisis? The case of farming communities in Thailand

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1 Introduction

The occurrence of localized pollinator crises is not unlikely in Thailand given its sustained deforestation rates and the four-fold increase of pesticide imports for agricultural application over the past decade. Anecdotal evidence from Chanthaburi province seems to corroborate reports of past pollinator deficits, which forced orchard farmers of this region to manage their crop pollination by renting bee hives or becoming beekeepers themselves. We conducted separate discrete choice experiments in Chanthaburi and Chiang Mai provinces in order to compare the value of measures aimed at conserving native pollinating bees as perceived by orchard farmers. The economy of both regions depends highly on the cultivation of bee pollinated orchards, yet no evidence for a local pollination crisis has been found for the latter.

2 Methods

Discrete Choice Experiment (DCE)

Two DCEs captured the choice behavior of individual farmers that were confronted with hypothetical scenarios describing alternative conservation interventions and their effects on the population of native bees (i.e. policy attributes). Farmers faced trade-offs between attributes of two „generic“ projects (Projs. A and B) and those of a status quo (No Proj.) scenario. Each of the 325 respondents (198 in Chiang Mai; 127 in Chanthaburi) chose one alternative from the twelve choice cards (Tab. 1) that were generated with a statistically efficient design, using Ngene software, producing 3900 choice observations.

Table 1. All attribute levels (left) and an example choice card (right, in green)

Levels [a]	Please choose the option that gives you the greatest satisfaction	Policy A	Policy B	No Policy
no, yes	Bee-friendly pest management	yes	no	no
no, yes	Improving native bee habitats	no	yes	no
no, yes	Fostering native bee husbandary	no	yes	no
-50, 0, 50	Changes in native bee population (%)	+50	0	-50
0, 250, 500, 750	Policy implementation costs (THB) [b]	500	500	0
	I choose:	**Policy A** ○	**Policy B** ○	**No Policy** ○

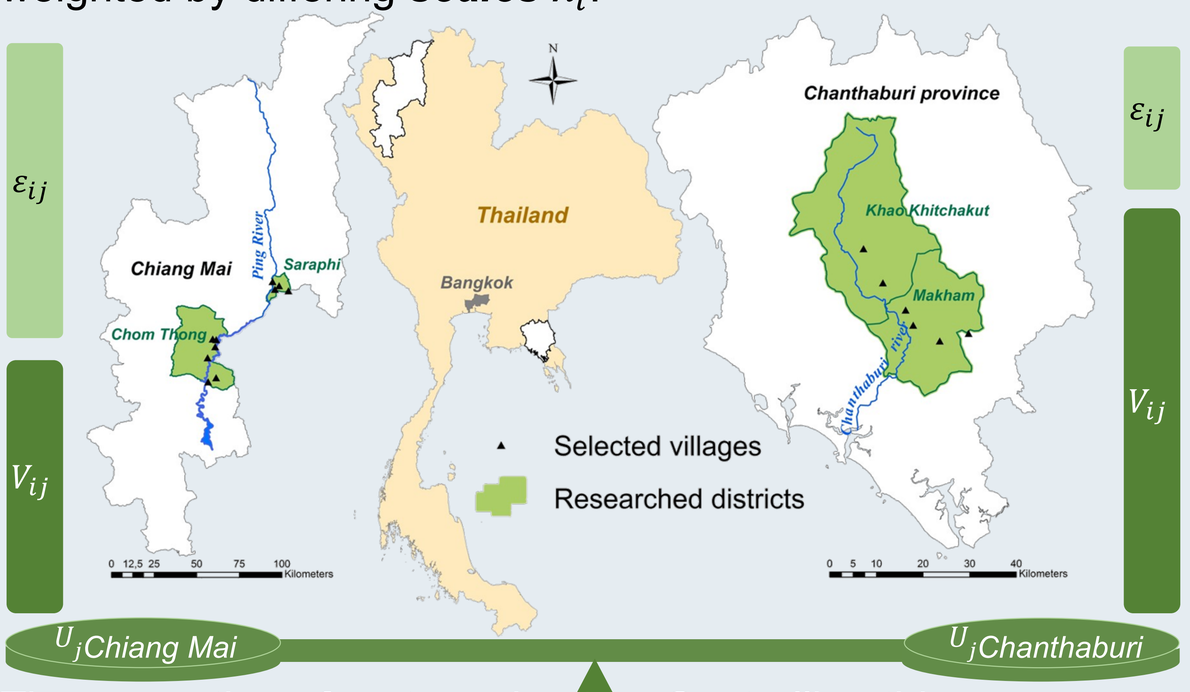
[a] The levels marked in bold correspond to the status quo alternative
[b] €1 = 44,43 Thai baht (THB), as of February 19, 2014
Source: Own representation

Generalized Mixed Logit (GMXL) model

A utility maximizing farmer i chooses an alternative h with superior utility from a set of J alternatives with utility given by:

$$U_{ij} = \lambda_i V_{ij}(X_j) + \varepsilon_{ij} = \lambda_i \beta' X_j + \varepsilon_{ij},$$

where V_{ij} is the portion of utility explained by the conservation policy attributes X_j, while ε_{ij} reflects residual utility from unobserved factors. The utility of different individuals i may be weighted by differing ***scales*** λ_i.



The proportion of V_{ij} to ε_{ij} is λ_i. Controlling this parameter sets a common base to compare and avoid estimation biases.

3 Results and Discussion

The GMXL estimates resulted highly significant and suggest a significant choice behavior heterogeneity. Such heterogeneity is partly captured by the standard deviations around the parameter means and partly explained by scale differences, i.e. λ_i (Tab. 2). Furthermore, model M1 suggests that farmers in Chanthaburi place a higher weight (λ) than Chiang Mai farmers do on the overall conservation policy relative to the residuals, i.e. Chanthaburi farmers have a smaller $var(\varepsilon_{ij})$ than Chiang Mai farmers.

Table 2. Preference and WTP estimates for Chiang Mai + Chanthaburi (pooled data)

	M1: Preference (β_i) [a]		M2: WTP_i [a] [b]	
Policy attribute	***mean***	***std. dev.***	***mean***	***std. dev.***
Bee-friendly pest management (PEST)	1.1976***	1.5203***	348.09***	512.51***
Improving native bee habitats (HAB)	1.2503***	1.0648***	355.66***	450.95***
Fostering native bee husbandary (BEEKP)	0.8433***	1.4388***	216.88***	452.15***
50% native bee pop. decrease (NB_DEC)	-5.4756***	1.4728***	-1305.45***	629.69***
50% native bee pop. Increase (NB_INC)	3.3063***	1.3599***	898.40***	576.43***
Policy implementation costs [b]	-0.0041***	0.0029***	-0.0047***	-
Heterogeneity in random parameter mean (ΔWTP)				
Chanthaburi [c] × *HAB*	-		356.1***	
Chanthaburi [c] × *BEEKP*	-		265.4***	
Chanthaburi [c] × *NB_DEC*	-		350.7**	
Parameters in scale (std. dev. of λ_i)	0.5379***		0.54113***	
Chanthaburi [c] *(explained heteroskedasticity)*	0.2367***		0.32619	
Log-Likelihood	-2488.633		-2558.905	
BIC/*N*; [AIC/*N*]	1.338	[1.291]	1.367	[1.326]

[a] Signif. levels: * p<.05, ** p<.001, *** p<.0001. [b] €1 = 44,43 Thai baht (THB), as of February 19, 2014.
[c] Dummy indicating respondent from Chanthaburi. Source: Own calculations using NLOGIT 5/LIMDEP 10

The GMXL framework allows introducing heterogeneity in costs preference β_{ic} through λ_i, thus delivering direct willingness to pay (WTP) estimates, i.e. the parameters for the distribution of the ratio $-\beta_{ik}/\beta_{ic}$ (where β_{ik} is the preference for any attribute k).

Model M2 indicates that Chanthaburi farmers are WTP more for some conservation policy measures than Chiang Mai farmers (Tab. 2), while the latter are WTP more to avoid a decline in the local population of native bees. This last result suggests that a local pollinator decline may have made Chanthaburi farmers more aware of the importance of conserving native bees, while (paradoxically) making them more independent from the natural provision of pollination services as they started managing their own crop pollination.

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