



Contingent Valuation with Multiple Bounded Format and Uncertainty Response of a Rural Spatial Planning Program in the South of Córdoba Province, Argentina

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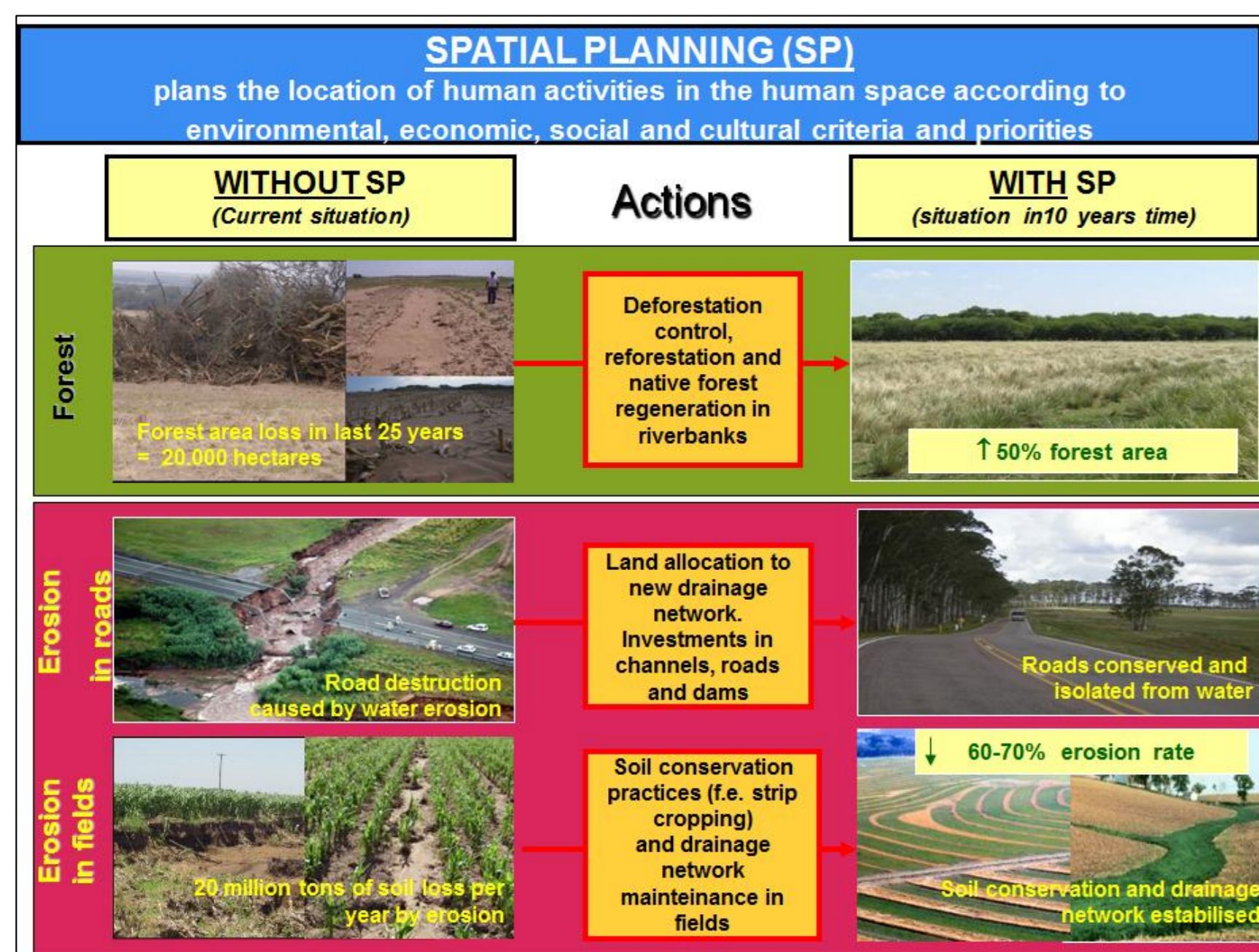
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Introduction

- Economic valuation of environmental quality or ecosystem services aims to reveal the value society gives to them in a comparable unit with market goods and services. Thus, it contributes to their inclusion in decision processes such as spatial planning avoiding their inefficient use or the unnecessary loss of some ecosystem service (Kroeger and Casey, 2007).
- Contingent Valuation (CV) uses a survey research methodology to ask for willingness to pay (WTP) or accept for an environmental improvement or damage respectively. The policy question can concern specific or multidimensional attributes, which is frequent in the environmental field. That would be the case of a rural spatial planning – that involves different measures, for example, soil and water conservation practices, reforestation, etc.

Figure 1.



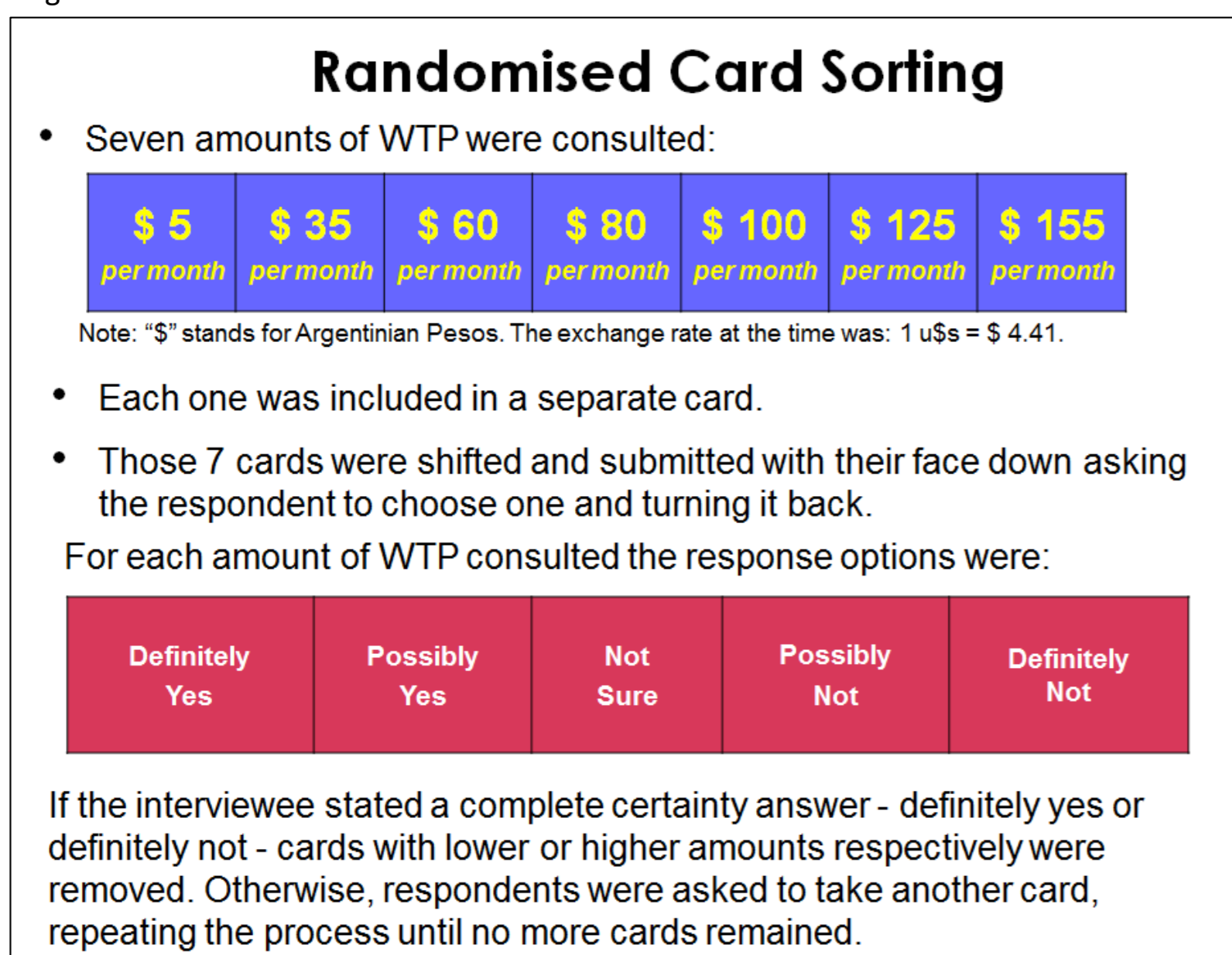
In the South of Córdoba province in Argentina there are some environmental problems, related to agriculture. These problems are perceived by urban population of this area, and soil erosion and deforestation are two of the main ones (Cristeche et al., 2011). A rural spatial planning program is a policy that can reduce these environmental effects of agricultural production and the social conflicts generated by them.

The objective of this study is the economic valuation of a rural spatial planning program in the south of Córdoba. The program take into account two attributes: the control of water erosion and the conservation of *caldén* forest (see details in Figure 1).

Materials and methods

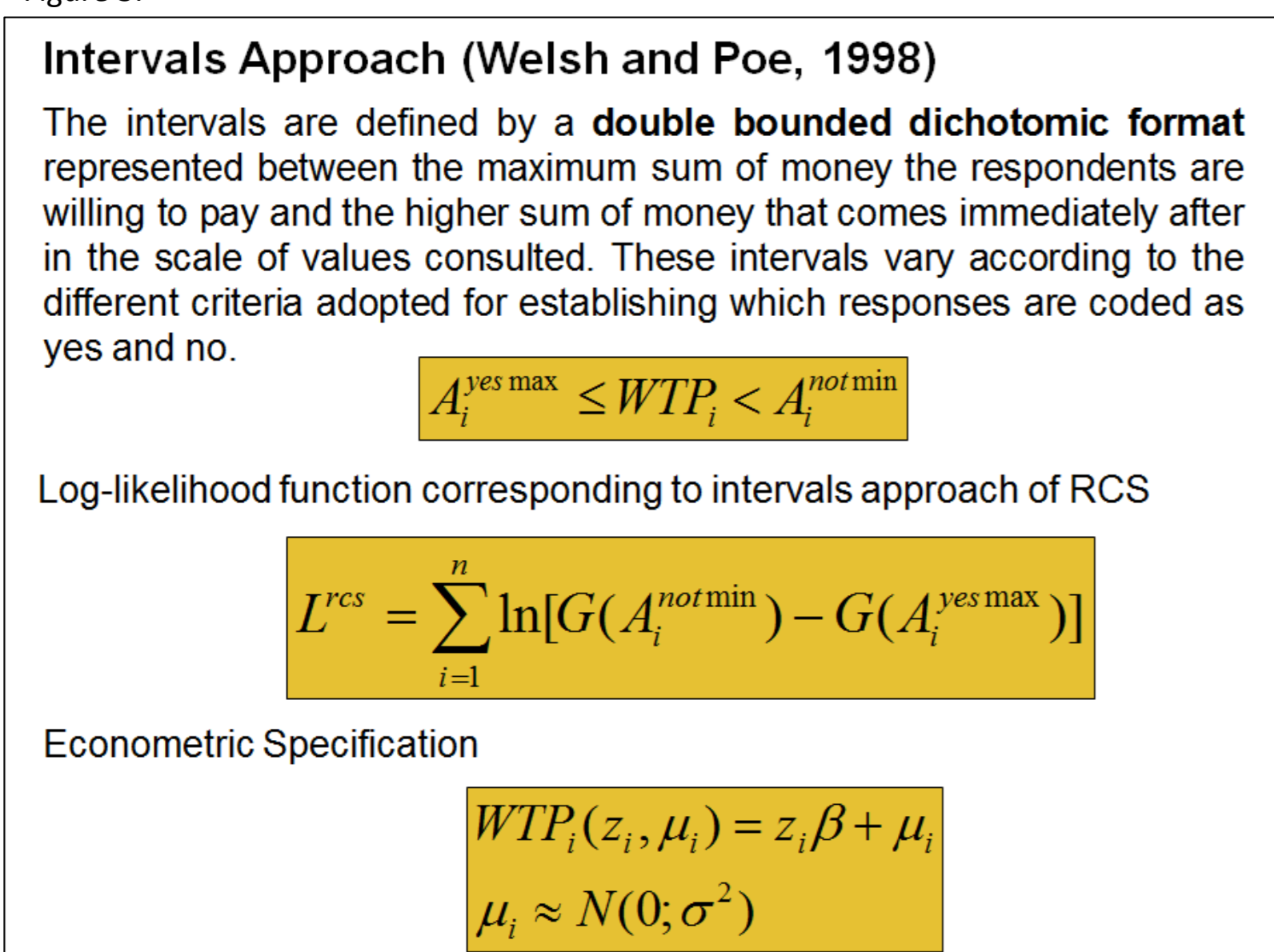
- The survey data corresponds to two locations: *Río Cuarto*, farther from *caldén* forest; and *Villa Huidobro* – nearer *caldén* forest.
- The sampling unit in both locations were households in which interviews were conducted to the head of household.
- A total of 716 questionnaires were completed.
- The CV format applied was multiple bounded with uncertainty response options, particularly what is known as randomised card sorting (See Figure 2).

Figure 2.



Regarding the estimates presented in this study, the intervals approach developed by Welsh and Poe (1998) was applied (Figure 3). The intervals approach consists in codifying answers that state uncertainty – *possibly yes*, *not sure* and *possibly not* – as definite answers (yes or no).

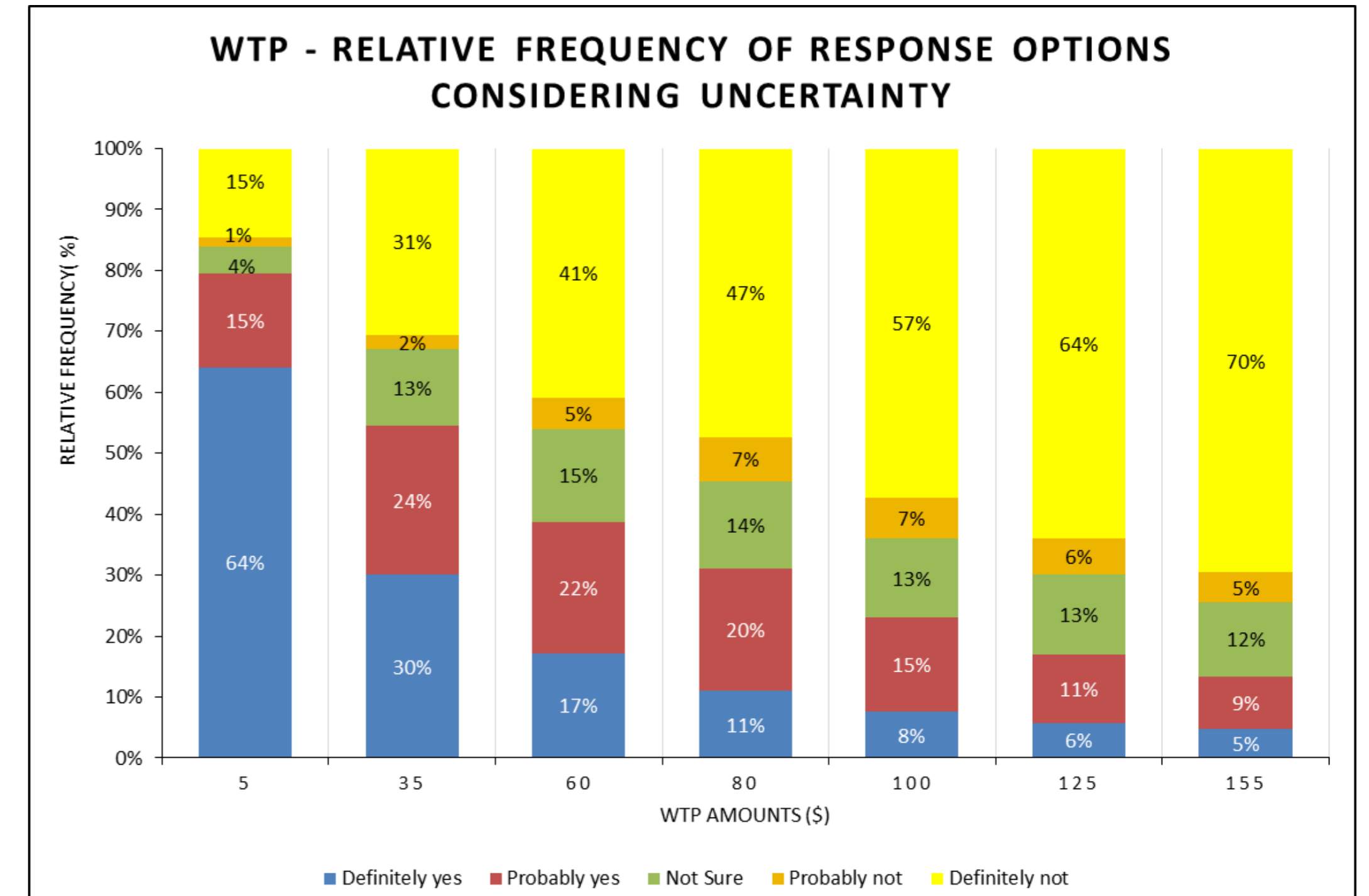
Figure 3.



Results

- The relative frequency of response options considering uncertainty for the seven amounts of WTP consulted (Figure 4) show that WTP decreases as the amounts consulted are higher as theoretically expected. Besides, response options of certainty – *definitely yes* and *definitely not* – prevail over those which express some sort of doubt or uncertainty.
- In Table 1 it can be seen that mean WTP has a considerable range of variation depending on the rule adopted to recode uncertainty responses.
- Mean WTP grows as the criteria for considering positive responses of WTP becomes laxer as it would logically be expected.
- These values range from \$ 18 to \$ 88 corresponding to the model in which *definitely yes* responses are the only ones considered as affirmative and the model where all responses are recoded as yes except for the categories of response *possibly not* and *definitely not*.
- These three estimates have a relatively good accuracy taking into account the close relationship between the mean WTP and the corresponding intervals. Intervals move within approximately \$5 in the three models.
- On the subject of the effects of covariates, the coefficients of binary variables representing different ranges of income (the omitted category is the lower income range) are all positive and significant in most cases.
- The age variable has negative and significant coefficients for all specifications, which denotes with certain strength the existence of an inverse relationship between age and WTP.
- Education also has a positive sign and its coefficient is significant at different levels for all specifications.
- WTP estimations are stable for different model specifications by including or excluding one of the different covariates
- Regarding the validity of the CV format applied, it must be noted that almost the totality of the respondents stated that the information exposed on the explanatory brochure was clear and enough, and that WTP question was clear as well.

Figure 4.



Note: Total responses (without inconsistent and protest responses) = 552, expressed in % per WTP amount.

Table 1. Parameter estimates of WTP for different specifications concerning uncertainty responses

	Definitely Yes (1)	Possibly Yes (2)	Not Sure (3)
Beta			
rio cuarto	3,80 (5,75)	3,04(6,97)	-4,08 (8,91)
woman	6,97 (5,54)	7,30(6,69)	8,57 (8,64)
hou_mem_	-0,77 (1,64)	1,50(1,99)	0,81 (2,55)
cohab	-7,09 (9,00)	-19,11(10,93) *	-11,45 (14,21)
married	0,84 (7,70)	-7,96(9,37)	2,60 (12,06)
separated	-16,31 (15,72)	-35,32(18,29) *	-53,70 (23,11) **
divorced	-3,82 (13,18)	-14,71(15,75)	-10,45 (20,19)
widowed	-3,80 (10,27)	-24,60(12,44) **	-30,08 (15,74) *
I (\$1500-4000)	11,57 (6,59) *	17,36(7,90) **	16,94 (10,01) *
I (\$4000-8500)	20,42 (8,48) **	32,86(10,31) ***	44,66 (13,45) ***
I (\$8500-1400)	63,41 (13,42) ***	83,04(17,31) ***	84,43 (23,58) ***
I (>\$14,000)	45,57 (32,13)	91,95(42,28) ***	67,03 (55,08)
education	3,19 (1,34) **	5,18(1,65) ***	6,20 (2,14) ***
age(years)	-0,71 (,19) *	-0,90(,23)	-1,51 (,30) ***
_cons	22,70 (15,71)	56,49(19,17) ***	117,91 (24,92) ***
Sigma			
_cons	50,3(2,20) ***	62,88 (2,63) ***	79,66 (3,73) ***
WTP	18,61 [13,63-23,58]	52,93 [47,12-58,75]	88,47[80,94- 96,01]
N	514	514	514
Wald chi2(16)	98,6	151,48	161,96
Prob > chi2	0,00	0,00	0,00
LL	-798,93	-953,71	-941,26
Akaike	1629,87	1939,42	1914,53

Notes:

- "definitely yes" = "yes"; "possibly yes," "not sure," "possibly not" and "definitely not" = "no"
- "definitely yes" and "possibly yes" = "yes"; "not sure," "possibly not" and "definitely not" = "no"
- "definitely yes," "possibly yes" and "not sure" = "yes"; "possibly not" and "definitely not" = "no"

* significant at 10%, ** significant at 5%, ***Significant at 1%

Conclusions

- Multiple bounded format with uncertainty response options – specifically randomised card sorting - is a variant of CV recommended as a solution to biases found in widely used payment card and single bound dichotomous formats. We use this procedure to attach a monetary value to environmental problems in the context of spatial planning with promissory results .
- Our results are consistent with economic theory and statistically stable, and the procedure to state WTP is well defined. The WTP is positive with respect to income and the probability of WTP is higher when the amount of WTP consulted is lower. The regression results are statistically stable when different covariates are included. The information given in the didactic material and the WTP question was found clear, precise and enough to understand the environmental problem according to interviewees. Thus, this procedure allows us to include the economic dimension in the sustainable approach for rural spatial planning.
- We believe that the procedure and application of CV is useful to obtain the economic value of the impacts of agricultural production and their externalities. Besides, the economic value obtained can be included in a more comprehensive approach, such as, multicriteria analysis and benefit cost analysis in order to help policy makers with the design of rural spatial planning.
- The estimated mean of WTP varies according to the decision rule considered following the intervals approach. Hence exploration of other alternatives of empirical treatment of the data for this CV format is pending in order to obtain more accurate values.

Literature cited

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