Assessing public commitment to endangered species protection: a Canadian case study

Supplementary Material 1

Details of cumulative logit model (CLM) analyses

Data management

We first reversed the response for the B (utilitarian) versions of the 3 scenario questions, such that 5 would be the most pro-conservation answer (strongly disagree), while 1 would be the least pro-conservation (strongly agree), to match the other questions in the survey.

We divided the continuous factor 'age', and the categorical factors 'education level' and 'income level' into factors with four categories. Age was categorized as follows: 18-24 years, 25-49 years, 50-74 years, and 75 years or older. Education level was categorized as follows: high school diploma or less, college or university or trades certificate at a level below the bachelor's level, bachelor's degree, and graduate degree (Master's, Medical, or Doctorate). Income level was categorized as follows: lower than $45,000 per year, $45,000 to $90,000 per year, $90,000-$150,000 per year, and more than $150,000 per year.

Before the analysis of each question, we removed respondents who had selected "don't know" or "prefer not to answer". These responses represented less than 6% of responses in all cases, and do not fit logically into the ordered categorical response.

Differences between versions

To check for differences between A (conservation) and B (utilitarian) versions of the survey, we used CLMs including version as the only explanatory variable. We used the 'ordinal' package in R, which uses maximum likelihood to estimate the CLM (Christensen 2015). Survey

version was deemed to affect the response significantly if the Wald test results provided by the 'summary' function for the fitted model were significant for the factor 'version'. We tested for differences in responses to the first two questions between versions (identical questions in both versions) to rule out a pre-existing difference between the randomly selected group of respondents for each version. We also tested for differences in response for the other identical question between versions (questions 4, 6 and 8) in order to test whether exposing respondents to utilitarian-framed scenario questions caused them to answer subsequent non-scenario questions differently than respondents who had been exposed to conservation-framed scenario questions.

Before running each CLM we checked whether the proportional odds assumption was met for the explanatory factor 'survey version'. We also compared models based on symmetric, flexible, and equidistant threshold parameterizations, and chose the best threshold type based on pairwise model comparisons (Christensen 2015). We confirmed model convergence for all models before doing model comparisons.

It is important to note that CLM models take into account the ordered nature of the response variable, and therefore they are expected to be more sensitive to differences than a categorical test such as the Chi^2 test.

Analysis of the seven demographic factors

If we found a significant difference between survey versions for the response to a question, we analyzed the two versions separately as a function of the demographic factors. Before building a CLM for each question, we checked whether the proportional odds assumption was met for each demographic explanatory variable. If this assumption was violated, we included the factor in question as a nominal term in the model (Christensen 2015). We
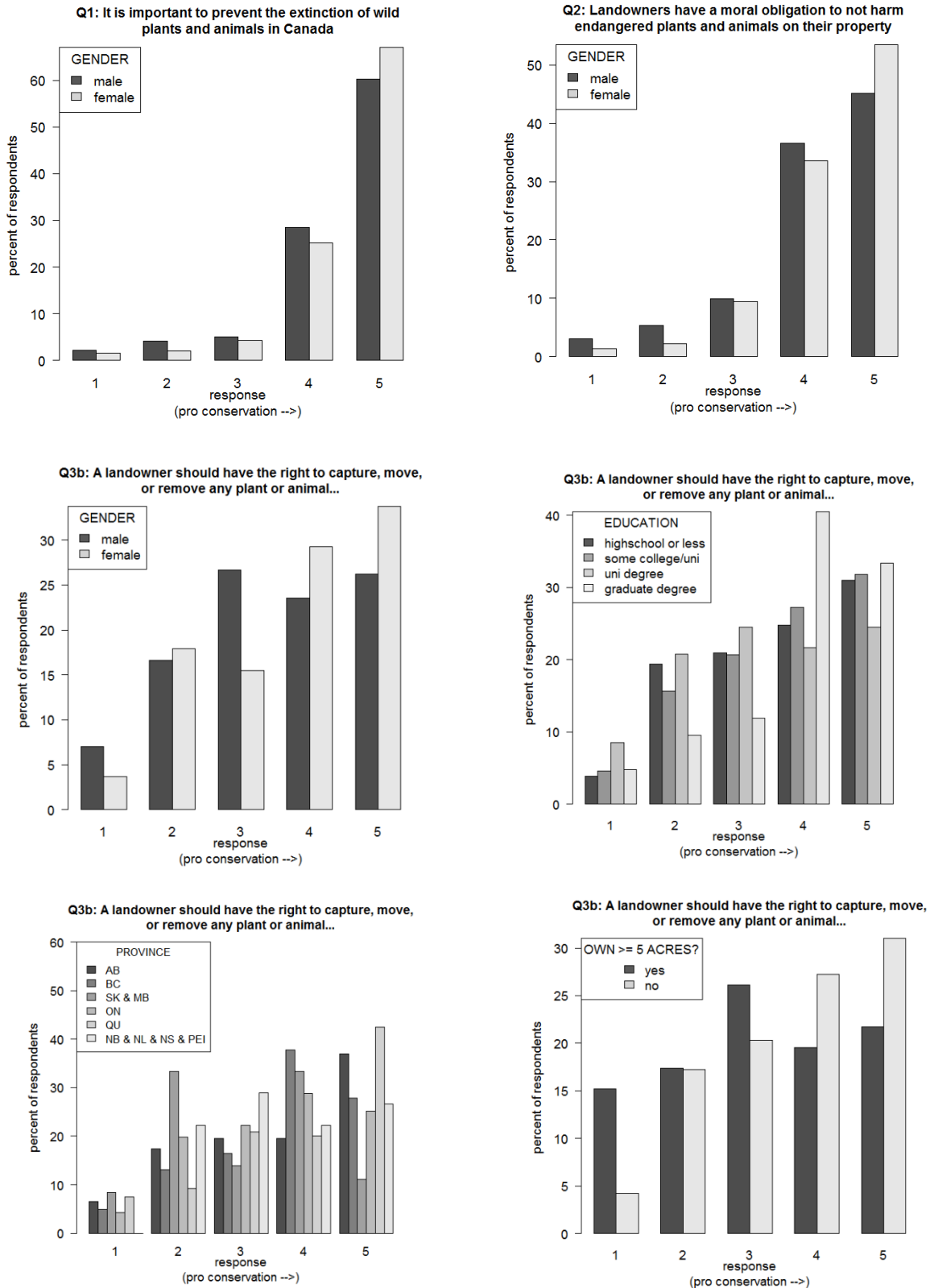
compared models based on symmetric, flexible and equidistant thresholds and chose the best type based on pairwise model comparisons. Once we had run the best model including all seven demographic variables, we tested the significance of each factor based on marginal fitting of each term with a Chi^2 test using the 'drop1' function.
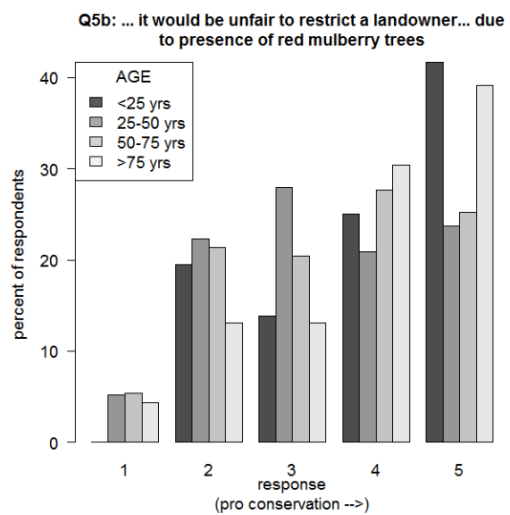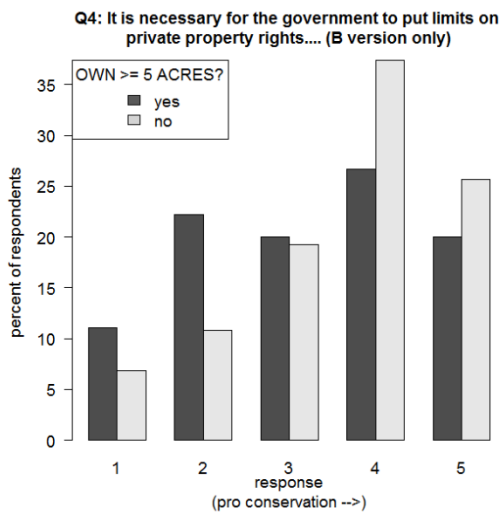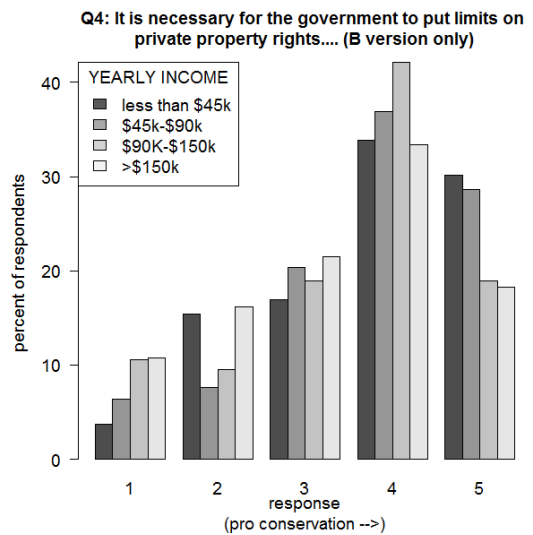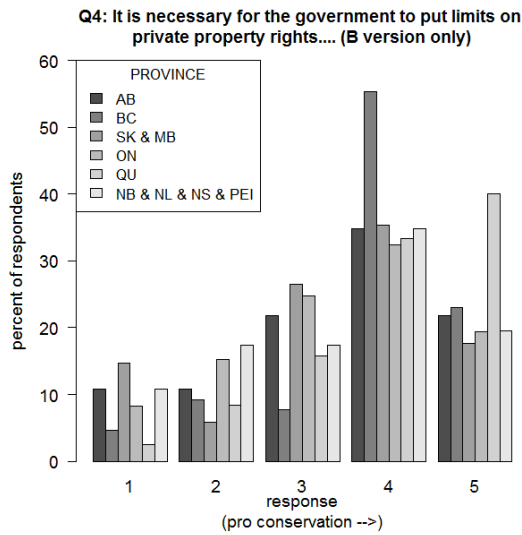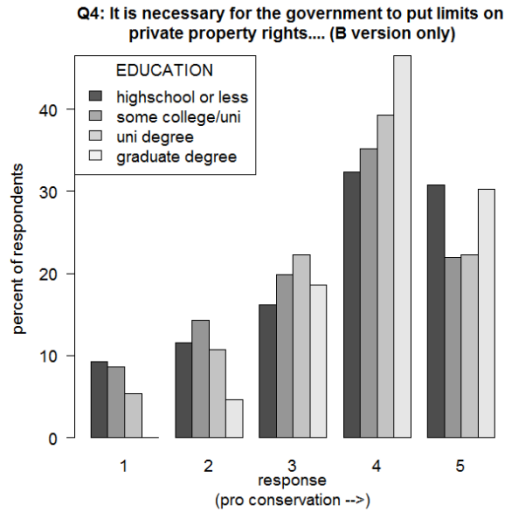
When a factor violated the proportional odds assumption, it was fitted as a nominal variable, and a single odds ratio cannot be calculated because in this case the odds ratio changes depending on which two categories of the ordinal response are being compared. In these instances, we calculated the odds ratio based on a model with proportional odds to report in Table 3, but note that the odds will actually differ depending on the threshold (e.g. response shift from "agree" to "strongly agree" may have different odds ratio than response shift from "neither agree nor disagree" to "agree").

Reference

Christensen, RHB. 2015. A Tutorial on fitting Cumulative Link Models with the ordinal Package. [online]:Available from https://cran.r-project.org/web/packages/ordinal/vignettes/clm_tutorial.pdf [Accessed 20 March 2015].

Figure S1. Bar plots illustrating demographic factors found to be significant predictors of the response to one or more survey questions

Q4: It is necessary for the government to put limits on private property rights.... (B version only)

AGE
- <25 yrs
- 25-50 yrs
- 50-75 yrs
- >75 yrs

percent of respondents

response
(pro conservation -->)

Q4: It is necessary for the government to put limits on private property rights.... (B version only)

EDUCATION
- highschool or less
- some college/uni
- uni degree
- graduate degree

percent of respondents

response
(pro conservation -->)

Q4: It is necessary for the government to put limits on private property rights.... (B version only)

PROVINCE
- AB
- BC
- SK & MB
- ON
- QU
- NB & NL & NS & PEI

percent of respondents

response
(pro conservation -->)

Q4: It is necessary for the government to put limits on private property rights.... (B version only)

YEARLY INCOME
- less than $45k
- $45k-$90k
- $90K-$150k
- >$150k

percent of respondents

response
(pro conservation -->)

Q4: It is necessary for the government to put limits on private property rights.... (B version only)

OWN >= 5 ACRES?
- yes
- no

percent of respondents

response
(pro conservation -->)

Q5b: ... it would be unfair to restrict a landowner... due to presence of red mulberry trees

AGE
- <25 yrs
- 25-50 yrs
- 50-75 yrs
- >75 yrs

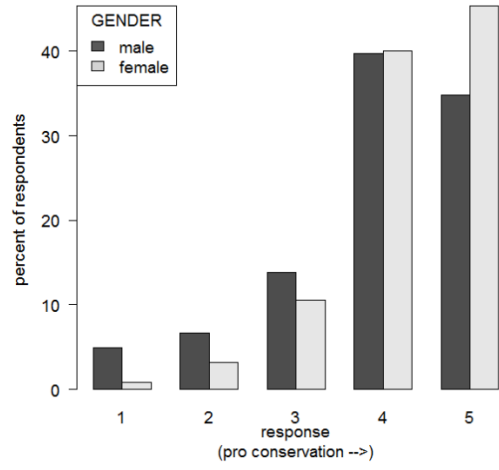percent of respondents

response
(pro conservation -->)

Q6b:It is necessary for the government to prevent industrial development in certain areas...
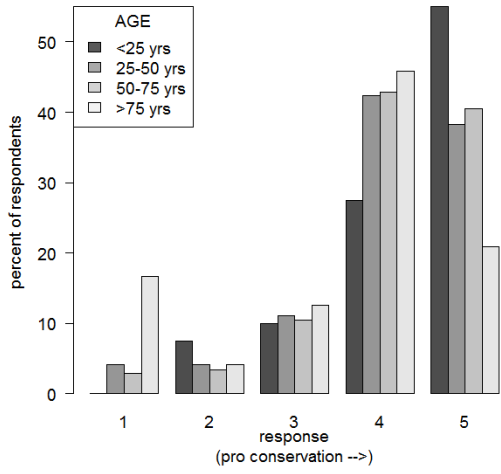
Q7a: The government is on the right track in limiting industry to save the sage grouse

Table S1. Results of Fisher's exact tests. These tests examined possible relationships between demographic variables and the nature of a shift from a principle question to its corresponding scenario question. Note that the number of respondents is lower for shifts from question 4 to question 5 because fewer respondents agreed with question 4: "It is necessary for the government to put limits on private property rights in order to protect endangered plants and animals in Canada."

	demographic predictors						
Question	gender	age	education	province	income	kids/no kids	own land?
From question 2 to question 3 (A version) N=406	p=0.214	p=0.374	p=0.699	**p=0.0062** *PEI and MB respondents more likely to shift to utilitarian*	p=0.373	p=0.683	p=0.604
From question 2 to question 3 (B version) N=415	**p=0.018** *more women stay pro-conservation while more men shift to neither*	p=0.304	p=0.2425	p=0.1574	p=0.6461	p=0.5845	p=0.479
From question 4 to question 5 (A version) N=332	p=0.986	p=0.726	p=0.810	p=0.616	p=0.605	p=0.671	p=0.606
From question 4 to question 5 (B version) N=296	p=0.368	p=0.080	p=0.583	**p=0.016** *higher proportion of SK and MB respondents shift to utilitarian response compared to other provinces*	p=0.687	p=0.107	p=0.441
From question 6 to question 7 (A version) N=408	p=0.250	p=0.142	p=0.513	p=0.075	p=0.321	p=0.294	p=0.610
From question 6 to question 7 (B version) N=399	p=0.169	p=0.566	p=0.938	p=0.682	p=0.162	p=0.146	p=0.378