Choice modelling and nature conservation

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International Choice Modelling Conference, Cape Town, 2017

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What I will discuss

A. What is the demand for nature conservation?
B. Who gets the benefits?
C. How can we finance conservation?
D. How can we incentive the supply side?
E. How to reduce illegal killing of wild animals?

➔Much of this research would not have been possible without Mikolaj Czajkowski

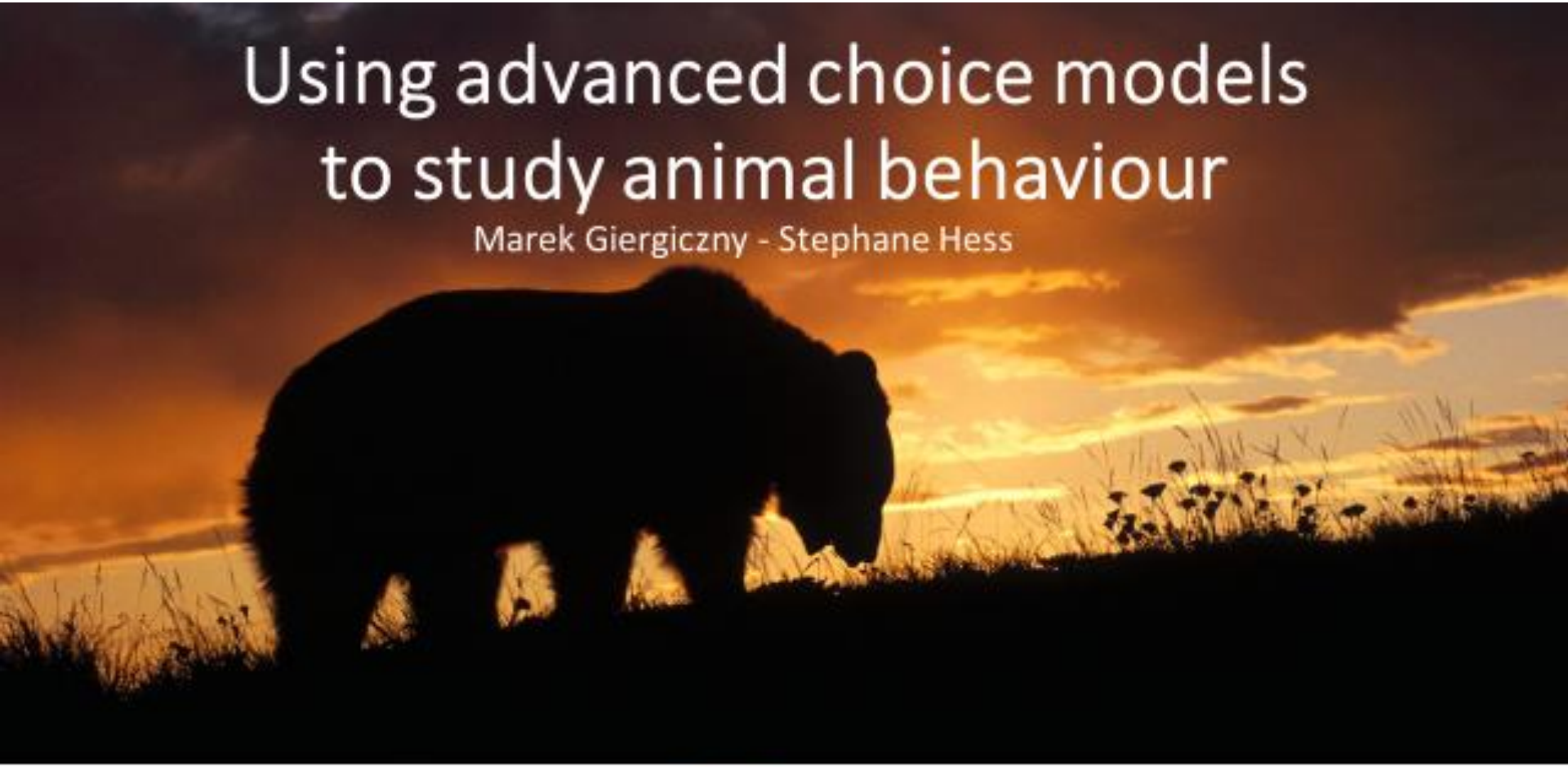
➔Thanks, Mik!

Economists are not the only people to use choice modelling in conservation planning..

- Used by conservation biologists to model wildlife movement eg choice of feeding sites from a choice set of alternatives
- Example: Dancose, K., Fortin, D., and Guo, X., 2011. Mechanisms of functional connectivity: the case of free-ranging bison in a forest landscape. *Ecological Applications*, 21(5):1871-1885.
- Predicting movement of bison between meadows in Prince Albert National Park, Canada. 29 sites in the choice set.
- Attributes: distance from home patch (= cost), area, plant biomass, deciduous-conifer ratio, water availability.
- Conditional logit models for summer, autumn, winter and spring showed preference heterogeneity between seasons for the “average bison”.

Using advanced choice models to study animal behaviour

Marek Giergiczny - Stephane Hess



Warsaw University
Warsaw Ecological Economics Center

choice modelling centre

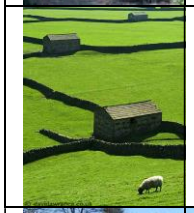
UNIVERSITY OF LEEDS

A. What is the demand for nature conservation?

- Hanley, N., MacMillan, D., Wright, R. E., Bullock, C., Simpson, I., Parsisson, D., and Crabtree, B., 1998. Contingent Valuation Versus Choice Experiments: Estimating the Benefits of Environmentally Sensitive Areas in Scotland. *Journal of Agricultural Economics*, 49(1):1-15.
- First use of choice modelling in environmental context in the UK
- We showed how much people in the UK are willing to pay for changes in how farmers manage the countryside, so that we get more biodiversity conservation
- Context: new policy of Environmentally Sensitive Areas, which offered payments to farmers to sign contracts for switching production methods
- We showed how the WTP of people varied according to which kinds of environmental benefit was targeted by the policy eg woodlands management compared to grasslands management
- We also showed how benefits varied over space
- Comparison of choice experiment estimates of the value of the policy with estimates from contingent valuation
- A very simplistic application of CE

More work on WTP for environmentally-friendly farming..

- Evolution of agr-environmental schemes to be better targeted at what people valued about public goods generated by these schemes at a regionally-differentiated level
- Hanley, N., Colombo, S., Mason, P., and Johns, H., 2007. The Reform of Support Mechanisms for Upland Farming: Paying for Public Goods in the Severely Disadvantaged Areas of England. *Journal of Agricultural Economics*, 58(3):433-453.

Policy Option	Current Policy	Policy Option A	Policy Option B
 Change in area of Heather Moorland and Bog	A loss of 2% (-2%)	A gain of 5% (+5%)	A loss of 2% (-2%)
 Change in area of Rough Grassland	A loss of 10% (-10%)	A gain of 10% (+10%)	A loss of 10% (-10%)
 Change in area of Mixed and Broadleaf Woodlands	A gain of 3% (+3%)	A gain of 20% (+20%)	A gain of 10% (+10%)
 Condition of field boundaries	For every 1km, 100 m is restored	For every 1km, 200 m is restored	For every 1km, 50 m is restored
 Change in farm building and traditional farm practices	Rapid decline	Much better conservation	No change
 Increase in tax payments by your household each year	£0	£40	£17
	Which do you like best?	☐	☐	☐

Willingness to Pay values, North West

(£/household/year)

Attributes	**Implicit price**	**95% lower bound**	**95% upper bound**
(shaded: significantly different from zero)			
Heather moorland and bog (1% increase)	0.78	0.45	1.11
Rough grassland (1% increase)	0.74	0.45	1.05
Mixed and broadleaf woodlands (1% increase)	0.61	0.30	0.91
Field boundaries (metre restored per km)	0.00	-0.03	0.04
Cultural heritage: from “rapid decline” to “no change”	1.03	-1.84	4.14
Cultural heritage: from “rapid decline” to “much better conservation”	4.89	1.52	8.43

Equivalent WTP values for Yorkshire

Attributes	Implicit price	95% lower bound	95% upper bound
Heather moorland and bog	0.30	-0.06	0.65
Rough grassland	0.31	0.01	0.60
Mixed and broadleaf woodlands	0.15	-0.16	0.48
Field boundaries	0.04	0.01	0.08
Cultural heritage: from “rapid decline” to “no change”	3.08	-0.24	6.71
Cultural heritage: from “rapid decline” to “much better conservation”	11.93	8.47	15.44

This shows that WTP for heather moorland is now zero, as it is for woodlands. Value for rough grassland is half as big cp. to NW.

So a big difference over the previous set of results.

But what are people willing to pay for biodiversity conservation itself?

- What are the “attributes” of biodiversity which people care about?
- Christie, M., Hanley, N., Warren, J., Murphy, K., Wright, R., and Hyde, T., 2006. Valuing the Diversity of Biodiversity. *Ecological Economics*, 58(2):304-317.

Aspects of biodiversity included in choice experiment design

- Familiar species of wildlife
- Rare (unfamiliar) species of wildlife
- Habitat quality
- Ecosystem services

- Plus a price term (increase in taxes)

Familiar Species of wildlife

... any bird, mammal, reptile or plant that is likely to be recognised by members of the general public.

Common familiar species :

- Squirrel
- Kestrel
- Blue tit
- Poppies

Rare familiar species :

- Otter
- Brown Hare
- Skylark
- Song thrush

Implicit prices (WTP /hld/yr) for Cambridgeshire sample

Attribute	*Implicit Price*	*SE*	*95%lower*	*95%upper*
Familiar-RARE	35.65	17.19	1.95	69.34
Familiar- RARE plus COMMON	93.49	18.03	58.15	128.82
Un-Familiar : slow down loss	-46.68	15.88	-77.80	-15.55
Un-Familiar: recovery	115.13	21.22	73.53	156.72
Habitat - RESTORE	34.4	15.32	4.37	64.42
Habitat – CREATE NEW	61.36	17.52	27.02	95.69
Ecosystems-HUMAN	53.62	16.97	20.35	86.88
Ecosystems-ALL	42.21	19.23	4.51	79.90

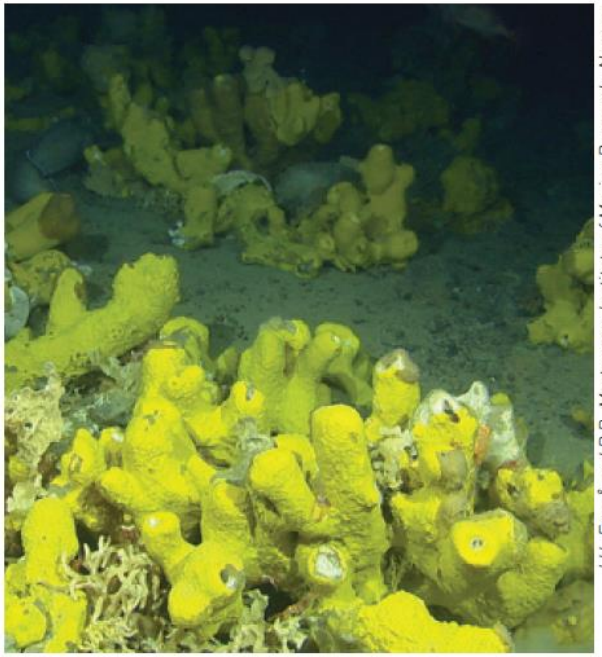
Effects of information and knowledge

- Clearly, how much people know about nature conservation and biodiversity can be expected to affect their WTP
- In some cases, we can expect ex ante knowledge to be "low"
- We measured such knowledge for one very unfamiliar nature conservation context: cold water corals

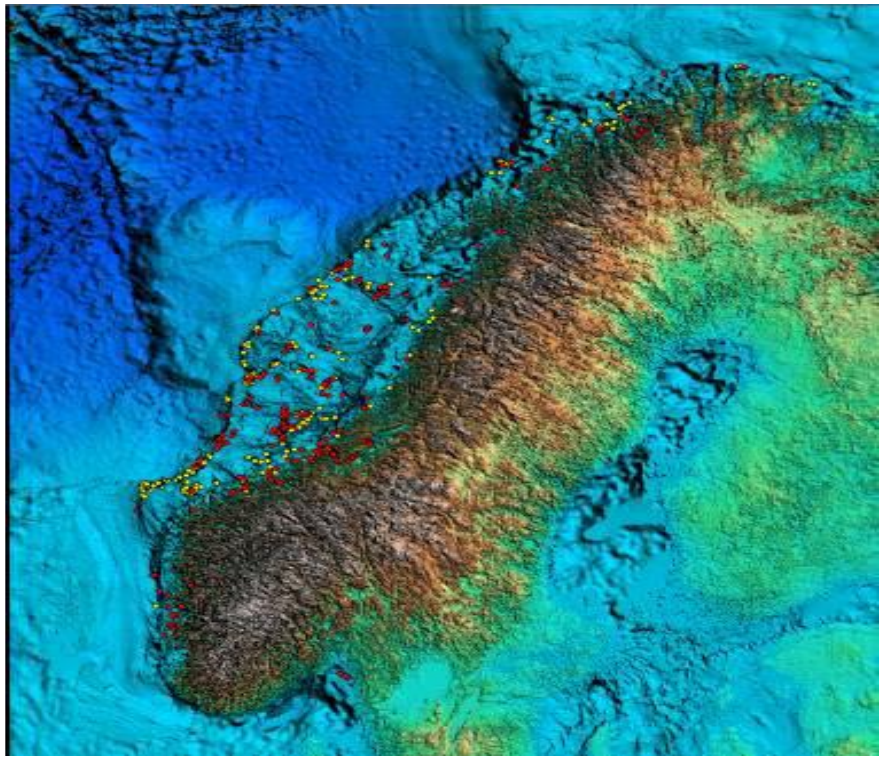
- LaRiviere, J., Czajkowski, M., Hanley, N., Aanesen, M., Falk-Petersen, J., and Tinch, D., 2014. The value of familiarity: Effects of knowledge and objective signals on willingness to pay for a public good. *Journal of Environmental Economics and Management*, 68(2):376–389.

An illustration

- What are the values of protecting biodiversity and ecosystem services in the deep sea?
- Deep sea: areas below 200m. Corresponds to 64 per cent of the surface of the Earth and 90 per cent of our planet's ocean area
- Problem: most people have almost zero knowledge or experience of deep sea ecosystems (eg sea mounts, abyssal plains, vents..); and almost zero awareness of the creatures that inhabit these systems.
- Scientific knowledge is also lacking: only about 3% of sea floor is "properly mapped" in public domain, whilst guess as to number of species is 0.5 million – 100 million (Koslow, 2007)



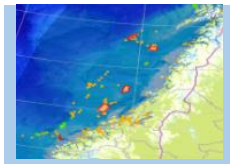
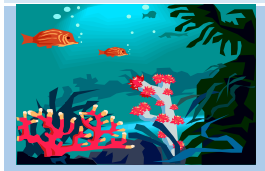
Cold water corals off the coast of Norway



Figur 1 Gule prikker er korallrev som er rapportert av fiskere og andre, røde prikker er verifiserte forekomster av KK langs norskekysten per 2004 (Havforskningsinstituttet, hentet fra MD sin hjemmeside)

- A choice experiment
- Data collected using a series of "**valuation workshops**",
- People expressed preferences for area of CWC protected, whether area was used for fisheries or oil/gas exploration, and how important it was as a habitat for fish

Figure 1. Example choice card

Characteristics		*Alternative 1*	*Alternative 2*	*Alternative 3 (status quo)*
Size of protected area		*5.000 km²*	*10.000 km²*	*2.445 km²*
Attractive for industry		*Attractive for both oil/gas and the fisheries*	*No, not attractive for any industry*	*To some degree attractive for both oil/gas and the fisheries*
Importance as nursery- and hiding area for fish		*Not important*	*Important*	*Not important*
Cost per household per year		*100 NOK/year*	*1000 NOK/year*	*0*
I prefer				

Experimental design

- Step one: subjects given multiple choice questionnaire on cold water coral (8 questions)
- We then figured out how highly each person scored on the quiz – this is a measure of their ex ante knowledge
- Treatment: half of the respondents are then told, confidentially, about their score (how much do they know?)
- Everyone then completes an individual choice experiment on cold water coral conservation
- Data collected from 397 people who joined one of 24, 2-hour workshops in 22 different parts of Norway

Results

- We find that the causal effect of objective signals about the accuracy of a subject's knowledge for a public good can dramatically affect their valuation for it: treatment caused a significant increase of $85-$129 in WTP for "well-informed" individuals.
- We find no such effect for less informed subjects.
- Better-informed subjects had a higher WTP and higher scale than less well-informed subjects, although no causal effects can be established here.
- Our results imply that WTP estimates for changes in biodiversity are not only a function of the information states of individual respondents (how much do they know?) but also their *beliefs* about those information states.

Effects of information and knowledge

- How much information to provide?
- What information to provide?
- How to facilitate learning?
- Control?

- Make WTP-estimates meaningful and reliable
  - Incentive compatibility
  - Consequentiality

ADDRESSING EMPIRICAL CHALLENGES RELATED TO THE INCENTIVE COMPATIBILITY OF STATED PREFERENCE METHODS

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Ewa Zawojska

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Hybrid Choice Models and accounting for the endogeneity of indicator variables: a Monte Carlo investigation

Wiktor Budziński,

Mikołaj Czajkowski

Disentangling status quo bias and zero-price effect for more robust estimation of welfare changes

Jeff Tjiong, Marek Giergiczny, Stephane Hess, Thijs Dekker, Mikołaj Czajkowski

5th International Choice Modelling Conference

3-5 April 2017, Cape Town

choice modelling

UNIVERSITY OF LEEDS
Institute for Transport Studies

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E. How to reduce illegal killing of wild animals?

B. Who gets the benefits of biodiversity conservation?

- Hanley, N., MacMillan, D., Patterson, I., and Wright, R. E., 2003. Economics and the Design of Nature Conservation Policy: A Case Study of Wild Goose Conservation in Scotland Using Choice Experiments. *Animal Conservation*, 6(02):123-129.
- Conservation polices for wild geese in Islay (western Scotland)
- Preferences for (i) species numbers (ii) how these were managed (lethal control or not) (iii) which kinds of geese were targeted (common versus rare)
- We showed that tourists had very different preferences to local people
- Tourists prefer more geese, locals prefer fewer geese
- Locals vote for lethal control measures, tourists have negative WTP for such measures
- Could compare aggregate benefits to different groups with costs to Scottish government of their “geese conservation” payments scheme to local farmers.

Helping to resolve wildlife conflicts
Grouse moors and hen harriers in Scotland

- Hanley, N., Czajkowski, M., Hanley-Nickolls, R., and Redpath, S., 2010. Economic Values of Species Management Options in Human-Wildlife Conflicts: Hen Harriers in Scotland. *Ecological Economics*, 70(1):107-113.
- Preferences of general public for moorland management, in terms of impacts on hen harriers and golden eagles, management options and cost.
- General issue: the "conservation conflict" between managing moorlands for more grouse to shoot and the protection of raptor populations (which hunt grouse)

Hen harrier (female in flight)

Hen harrier study

- Attributes are changes in hen harrier populations, changes in golden eagle populations and management options (diversionary feeding, moving chicks and eggs, tougher law enforcement)

- Showed people were willing to pay to prevent decreases and to achieve increases in populations of both raptors; but were indifferent to which management strategy was employed to achieve these changes.

- **Provides valuable information on what kinds of policies which address the problem from the viewpoint of land managers would also be supported by the public and recreational users.**

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C. How can we finance nature conservation?

- Conservation actions impose opportunity costs on local land-managers, as well as revenue costs of eg anti-poaching patrols
- So how to raise funds to offset such costs?

Two options we have investigated with choice modelling are:

- Ecotourism (Rwanda, Caribbean)
- Trophy hunters (Ethiopia)

Rwanda

- Bush, G., Colombo, S., and Hanley, N., 2009. Should all Choices Count? Using the Cut-Offs Approach to Edit Responses in a Choice Experiment. *Environmental and Resource Economics*, 44(3):397.
- How to use revenues from wildlife trekkers to offset costs of conservation in Virunga National Park?

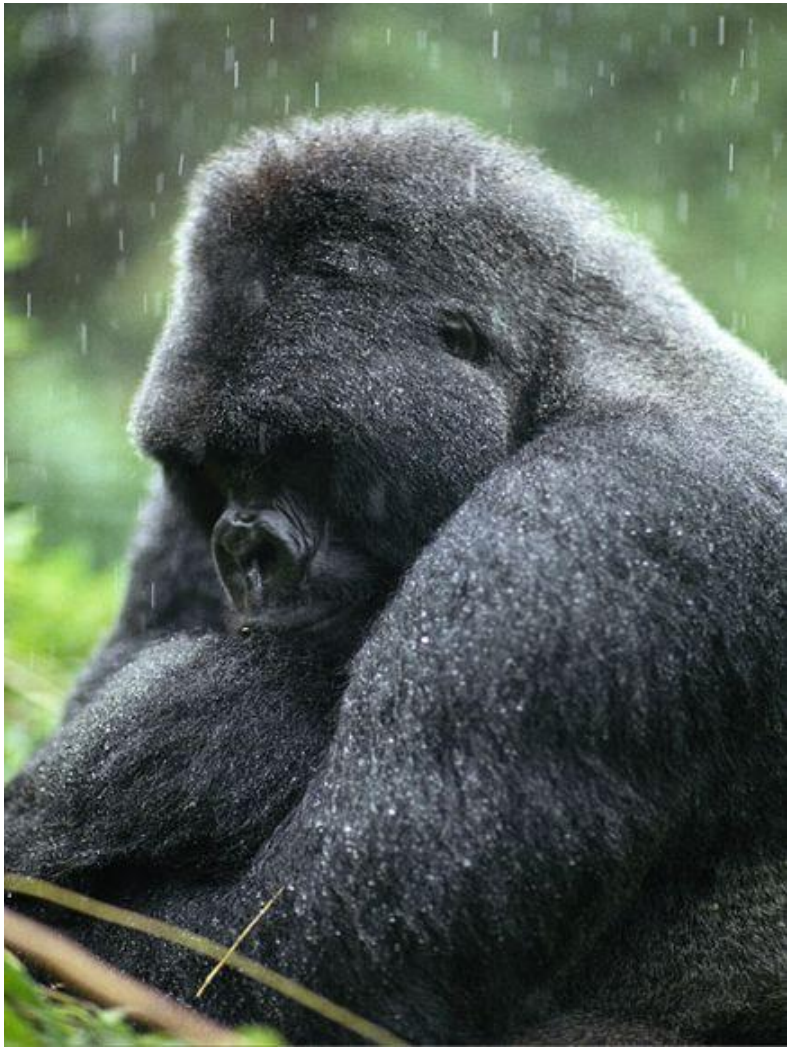

Table 1 Attributes and their levels

Attribute	Description (a more comprehensive description was provided in the survey instrument)	Levels
Tour Group Size	The number of tourists in a group. Limited to a maximum of 8 for conservation reasons	Small-4 Medium-6 Large-8
Length of trek	The amount of time taken to reach the gorillas.	Short, <1hour Medium, >1 but <3 Long, > 3hours
Community Benefit	Currently 20% of gate gross park revenues is diverted towards financing development activities in communities adjacent to the national park. Focus groups showed that some visitors felt it is important that local communities receive greater benefits from tourist spending.	No change 10% more 20% more 30% more
Other wildlife	The ability of tourists to see other flora and fauna the park can contribute to the richness of the trek experience.	High Medium Low
Permit price increase	Price *increase* on gorilla trek permit and implied new total (including park entry fee) – figure in parentheses shows new total fee.	$25 ($400) $50 ($425) $75 ($450) $100 ($475) $150 ($525) $200 ($575)

Trophy hunting in Ethiopia

- Fischer, A., Weldesemaet, Y. T., Czajkowski, M., Tadie, D., and Hanley, N., 2015. Trophy hunters' willingness to pay for wildlife conservation and community benefits. *Conservation Biology*, 29(4):1111-1121.
- Conservation of lowland habitats important for species such as white-eared kob
- Pressure on wildlife habitats increasing due to competing land uses - livestock grazing and conversion to cropland (Tadie and Fischer, 2013)
- Contrasts with high importance that conservation scientists place on Afro-alpine habitats in which are found many endemic species, such as mountain nyala and Walia ibex.

No legal access to controlled hunting areas for domestic livestock for grazing, but happens anyway

Choice experiment with international trophy hunters

- Bag mix (species allowed to shoot)
- Experience at hunting site (other wildlife; grazing livestock)
- Share of revenues to local community
- Share of revenues to government (national, regional)
- Trip length in weeks
- Trophy fees

Each respondent completed 8 choices like the one below

Please mark your preferred options (only one from each choice card)

	A	B	C	D
Bag mix	Nile lechwe and white-eared kob	Mountain nyala and other highland game	Mountain nyala and lowland game	No trip to Ethiopia
Experience of hunting site	Some livestock and some wildlife	A lot of wildlife, no livestock	A lot of wildlife, no livestock	
Share to community %	0	20	30	
Share to government %	40	30	10	
Length of trip	1 week	4 weeks	2 weeks	
License fees	10,000 USD	40,000 USD	20,000 USD	
Your choice?	□	□	□	□

WTP for change in distribution of hunting fees (in 2014 USD)

Change in attribute	WTP (s.e.)	95% confidence interval
per percentage point of hunting fees redistributed to local communities	390	270 – 540
per percentage point of hunting fees redistributed to the central government	-190	-320 – -50

So by re-designing hunting packages, we could raise additional funds to more-than-compensate local people for cutting livestock densities ➔ wildlife wins out, but so do local people

Roberts et al, 2017

- Are divers in the Caribbean willing to pay to reduce damages to coral reefs?
- Here the damage comes from terrestrial over-grazing

This is the problem

Bonaire is internationally renowned as a high quality SCUBA dive destination (SCUBA Diving Magazine, 2015). However, like coral reefs worldwide, the health of Bonaire's reef is declining over the long-term.

Studies carried out on Bonaire's reef by the University of Maine (Steneck and colleagues 2003-2013) have shown the number of young corals is falling, and the diversity of fish species is changing. This will reduce the quality of the coral reef for diving.

This is the cause of the problem

Soil run-off from land is one cause of reef health decline. On Bonaire this is increased due to grazing by introduced goats, donkeys and pigs.

Goats, donkeys and pigs were introduced to Bonaire by Spanish settlers, they are not native to the island. Grazing by these animals reduces plant numbers, meaning that there are fewer roots to hold the soil, and it is washed onto the reef.

Increased soil on the reef reduces the number of young corals. In time this will lead to reduced coral cover and fish diversity. Increased soil in the water also reduces visibility for divers.

This is how we might solve the problem

One way to maintain the health of Bonaire's coral reef is therefore to reduce grazing. This could be done by:

- Restricting movements of grazing animals;
- Reducing the number of grazing animals on Bonaire;
- Restricting where goat farmers can graze their goats.

To maintain the reef requires funding. You already pay an annual nature (dive tag) fee of $25 to STINAPA, which is used for the running of the Bonaire National Marine Park. This study is to find out if you would be willing to pay a higher fee in the future, to be used to reduce grazing. This fee would be collected at the same time as the current nature (dive tag) fee, but would be administered by a new non-governmental organisation. The fee would be guaranteed to be used for this purpose.

Grazer Management
Visibility 75ft (25m)
Coral Cover Over 75%

Fish Decline 5%
Fee $55

Grazer Management
Visibility 100ft (30m)
Coral Cover Under 25%

Fish Decline 35%
Fee $55

No Management - current
Visibility 25ft (8m)
Coral Cover Under 25%

Fish Decline 35%
Fee $25

	Multinomial Logit		Latent Class Logit					
			Class 1		Class 2		Class 3	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Visibility	**0.012*** **	0.0014	0.0089	0.011	**0.020*** **	0.0050	**0.021*** **	0.0028
Coral cover	**0.013*** **	0.0012	**0.020*** **	0.010	**0.017*** **	0.0040	**0.020*** **	0.0021
Reduced fish decline	**0.029*** **	0.0031	0.015	0.026	0.0023	0.0095	**0.028*** **	0.0048
Cost	**-0.007*** **	0.0013	**-0.030*** **	0.0014	**-0.056*** **	0.0060	**-0.0074*** **	0.0030
Status quo	**0.34*** **	0.11	**3.90*** **	0.77	**-2.20*** **	0.32	**-2.10*** **	0.33
Class Share			0.16		0.18		0.66	

	Multinomial Logit	Latent Class Logit		
		Class 1	Class 2	Class 3
Visibility/m	$1.71	NS	$0.35	$2.83
Coral cover/ %	$1.86	$0.67	$0.30	$2.70
Reduced fish decline/ %	$4.14	NS	NS	$3.78
High reef health	$301.32	$50.25	$30.20	$378.16

- A three year-long pig control program initiated in 2016 is estimated to cost $38,000 in establishment costs, and $20,000 in annual running cost.
- The estimated 89,460 dive tags sold in 2014 funding the project through a user fee would require only + $0.42/diver for the first year, and +$0.22/diver/year in subsequent years,
- **This is well within SCUBA divers' willingness to pay as estimated in our choice experiment**.

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D. How to enhance the supply side

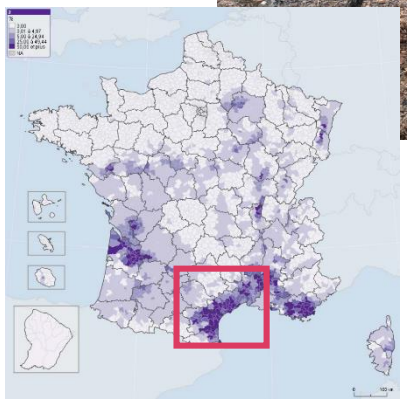
- Example: in Europe, the US and Australia, the state offers farmers contracts to switch to more conservation-friendly land management practices
- We can use choice modelling to figure out how changing the design of these contracts encourages sign-ups; and encourages spatial coordination
- Many examples now in literature
- For instance, Kuhfuss, L., Préget, R., Thoyer, S., and Hanley, N., 2015. Nudging farmers to enrol land into agri-environmental schemes: the role of a collective bonus. *European Review of Agricultural Economics* show how the introduction of an "agglomeration payment" can leverage in more participation, $ for $, than simple uniform payments

Our proposition: Introduction of a **bonus** paid, individually and in addition to the standard payment, *only if a predefined participation rate (50%) is collectively reached among local farmers*.

What effect on participation? Empirical measure with the choice modeling method

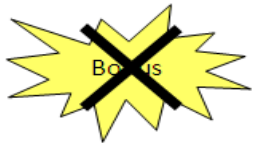
→Propose to winegrowers various AE contracts with different attributes (choice experiment)

- → Different levels of reduction (30%, 60%, 100%)
- → Flexibility term (yes/no)
- → Free advising (yes/no)
- → **Bonus: 150€/ha at the end of the 5 years contract** (yes/no)
- → Payment (from 90 to 500€/ha)



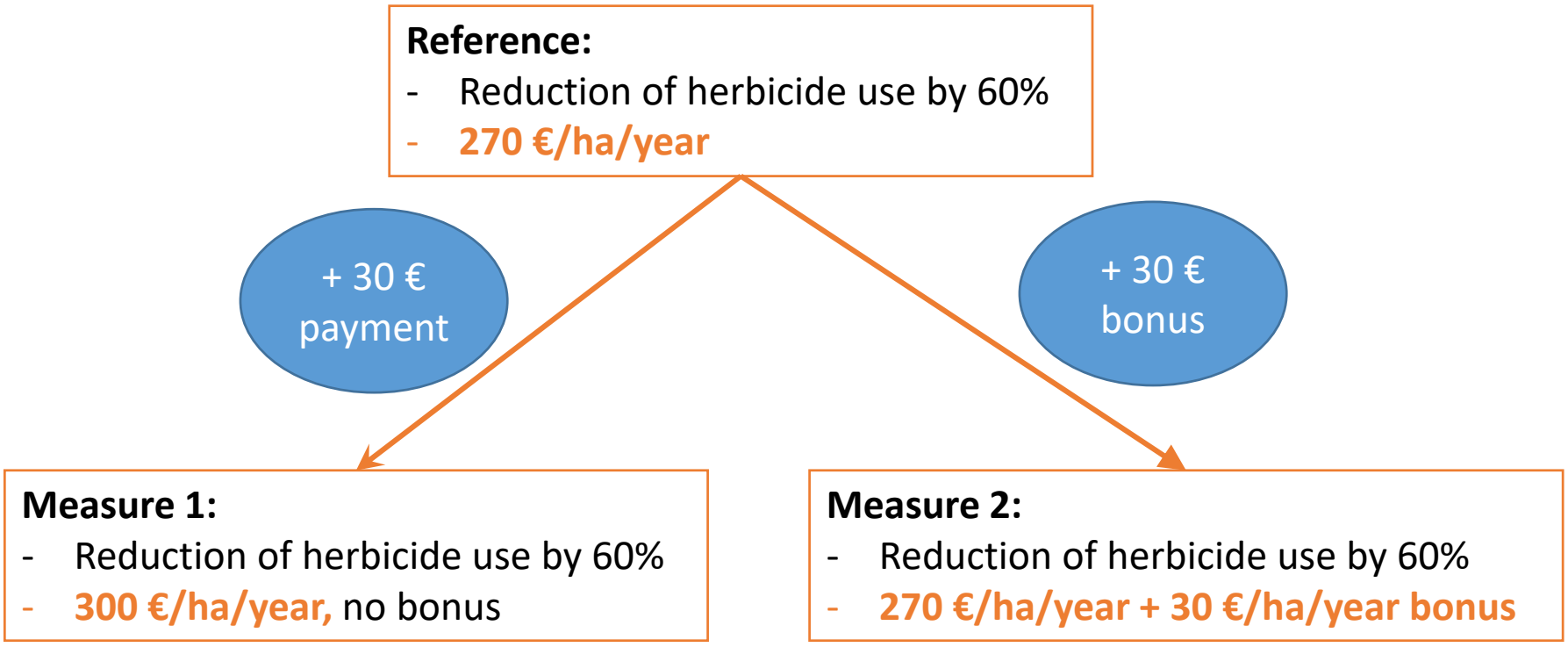
- Data collection
  - Internet survey sent to 3100 winegrowers
  - 317 complete answers (10,2%)

Example of choice card

	Alternative A	Alternative B	
Reduction of **herbicides** use in proportion of present use	**30 %** reduction 	**60%** reduction 	**Current situation**
Supplementary localized use of herbicides (max 10% of the committed area)	**Allowed** 	**Allowed** 	
Collective and final bonus for each farmer committed if **50% of**		**Final bonus**  **150€/ha**	
Administrative and technical assistance	**Not included** 	**Included** 	
Payment per year and per hectare subscribed	**170 €/ha/an**	**330 €/ha/an**	
Choose your preferred option →	☐	☐	☐

Each winegrower makes 6 choices

Effects on acreage enrolled



+ 0.8 % points in participation rates
+ 44.6 ha enrolled

+ 4.1 % points in participation rates
+ 265.7 ha enrolled

Do social norms matter?

Evidence from stated preference studies varying communicated social norm levels

Katarzyna Zagórska, Mikołaj Czajkowski, Jacob LaRiviere, Natalia Letki, & Nick Hanley

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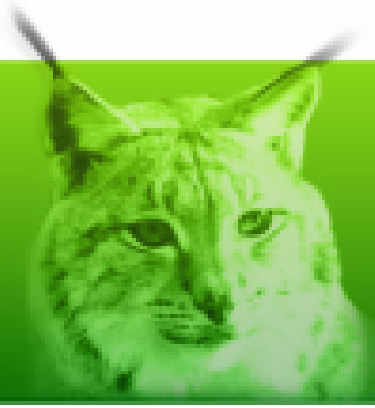
Warsaw Ecological Economics Center



GAIN AND LOSS OF MONEY IN A CHOICE EXPERIMENT. THE IMPACT OF FINANCIAL LOSS AVERSION AND RISK PREFERENCES ON WILLINGNESS TO PAY TO AVOID RENEWABLE ENERGY EXTARNALITIES.

Anna Bartczak, Susan Chilton, Mikołaj Czajkowski, Jürgen Meyerhoff

5th International Choice Modelling Conference
Cape Town, 3-5.04.2017

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E. How to reduce illegal wildlife hunting?

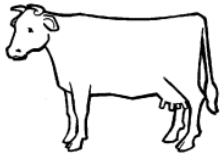
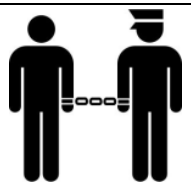
- Illegal killing of bushmeat in Africa
- Illegal killing of elephants for their ivory
- Illegal killing of rhinos for their horn

Illegal hunting in Serengeti

- Hunting for subsistence and/or trade
- Species
  - Wildebeest
  - African Buffalo
  - Giraffe
  - Zebra
  - Topi
  - Impala
- Method:
  - Wire snares
  - Guns

Bushmeat hunting: a “livelihood” CE

- Moro, M., Fischer, A., Czajkowski, M., D. Brennan, Lowassa, A., Naiman, L., and Hanley, N., 2013. An investigation using the choice experiment method into options for reducing illegal bushmeat hunting in western Serengeti. *Conservation Letters*, 6(1):37-45.
- Attributes:
  - Number of cows: no cows, 1 cow, about 15 cows, about 30 cows.
  - Wage rate: no job, 80,000 TSh per month, 200,000 TSh per month, or 600,000 TSh per month
  - Access to microcredit
  - Road to village centre accessible by lorry
  - Length of a hunting trip made once a year: no hunting, 1 week, 2 months and 6 months
  - Likelihood of being arrested per trip: nobody gets caught, one individual out of a group of ten, two individuals out of ten and four out of ten get caught.

		A	B	C
Number of cows		0	30	1
Wage per month		600,000 TSh	No job	80,000 TSh
Access to microcredit		Yes	Yes	No
Access to markets		Yes	No	Yes
Likelihood of being arrested		0	2/10	4/10
Time spent hunting per year		**1 week**	**2 months**	**6 months**
Which one would you choose?		[ ]	[ ]	[ ]

Main results

- People would be willing to trade off increases in cattle or employment for reductions in hunting activity
- Increasing risk of being caught also has an effect, which: (i) varies across households and (ii) is highly non-linear.
- We show that increasing alternative income-earning options is particularly effective for “poor” households, but that different policies would be needed for wealthier households.

Trade-off rates for livelihood attributes relative to 1 week per year reduction of illegal hunting

	MNL	RPL*	LC (class 1)	LC (class 2)
No. of cows for 1 hunting week	1.4725	2.6987	0.4665	9.6819
Job income (in thousands of TZS) for 1 hunting week	3.5939	5.0815	1.0352	21.4825
Hunting weeks for access to microcredit	0.8480	0.7136	3.2204	0.1552
Hunting weeks for access to market	0.8450	0.7360	3.1702	0.1528

* For respondents who currently do not own cattle or job income

Consumer Demand for Rhino Horn in Vietnam: insights from a choice experiment

(Hanley et al, 2017)

Trade in rhino horn products

- Is illegal
- However, recovery in the populations of rhino species in particular continues to be threatened by rising poaching rates over the last 10 years.
- The number of rhinos poached in South Africa has risen from around 60 in 2007 to 1,400 in 2015, due to strong demand in Asian economies.
- Prices for illegal poached horn are also thought to have increased substantially in recent years, from around USD 7,500 per kg (at 2013 prices) in 1993 to USD 28,000-100,000 per kg in 2013.

Consumers in Vietnam

- In Vietnam rhino horn is principally used in traditional medicine as a treatment for various ailments and conditions such as fever, delirium, convulsions, irregular palpitations, shortness of breath and as a purgative.
- More recently there are reports of rhino horn being promoted as a cure for cancer and as a hangover cure or detox treatment, and to enhance sexual performance (TRAFFIC, 2013).

- We undertook a choice experiment with customers of Chinese (traditional) medicine suppliers in Vietnam

Example choice card

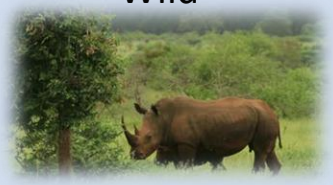
Source Farmed, Semi-Wild, or Wild

Rarity of Species Very Rare, Rare, Not Rare

Harvesting Method Lethal and Non-Lethal

Price (in USD per 100 grams)

1,200; 2,400; 3,600; 4,800; 6,000; 7,200; 8,400; 9,600

	Choice A	Choice B	Neither A or B
Source	Semi-Wild 	Wild 	
Rare?	Rare	Very Rare	
Harvesting method	Non-Lethal 	Lethal 	
Price per 100 grams	9,600 USD	2,400 USD	

Two scenarios

- Respondents made their choices in one of the following scenarios:

A. International trade in rhino horn remains illegal
B. Trade in rhino horn is legalised

WTP for products in illegal vs. legal scenarios

	Illegal	Legal
wild, very rare, lethal (base)	19.83	11.69
wild, non rare, lethal	19.89	11.91
wild, non rare, non lethal	24.30	16.90
farmed, very rare, lethal	17.20	7.58
farmed, non rare, lethal	17.25	7.79
farmed, non rare, non lethal	21.67	12.78
semi wild, rare, lethal	17.73	9.50
semi wild, rare, non lethal	22.15	14.49
semi wild, non rare, non lethal	23.10	15.37

WTP is **significantly lower** under the legal trade, for horn of any origin

➔ the introduction of a legal trade may reduce demand?

What I will discuss

- ✓ A. What is the demand for nature conservation?
- ✓ B. Who gets the benefits?
- ✓ C. How can we finance conservation?
- ✓ D. How can we incentive the supply side?
- ✓ E. How to reduce illegal killing of wild animals?

- There are some other interesting issues in applying choice modelling to nature conservation, which I have not had time to talk about

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