Experimental evidence for conservation conflict interventions: the importance of financial payments, community trust and equity attitudes

Supplementary materials

Table S1: Participant characteristics

Variables	Description		
Age	Numeric variable indicating the age of the participant	mean	45.53
		sd	14.89
		median	46.00
Gender	Categorical variable (two categories in our data, so treated as binary) indicating the gender of the participant	male	94%
Education	Numeric variable indicating the years of official schooling of the participant	mean	13.27
		sd	2.53
		median	13.00
Farming	Binary variable indicating whether the participant's primary occupation is farming	yes	79%
Subsidy	Binary variable indicating whether a participant's sources of income include environmental or agricultural subsidies	yes	34%
Utilised agricultural area	Numeric variable indicating the participant's total farm size in acres including arable land (temporary grassland and fallow land) and permanent grassland and crops.	Mean	380.30
		sd	355.98
		median	265.00
Arable land	Numeric variable indicating the participant's arable land size in acres	mean	55.46
		sd	73.62
		median	28.30
Crop damage	Numeric variable indicating the average self-reported estimates (in percent) of the amount of crop and grass losses caused by wild geese on participant's farm for the past 12 months	mean	20.04
		sd	19.27
		median	15.00
Number of geese shot on farm	Numeric variable indicating the total self-reported estimates of number of geese shot on the respondent's owned land for the past 12 months (including geese shot by other people).	Mean	50.00
		sd	142.42
		median	107.20
Shooting by participant	Binary variable indicating whether the participant has ever done any shooting	yes	56%
Total livestock	Numeric variable indicating total livestock owned by the household in livestock unit	mean	195.50
		sd	177.33
		median	140.00
Relationship in the group	Numeric variable indicating the strength of relationship in the group (how well they know each other) – varies from 1 to 12, the higher to more familiar participants are towards each other.	Min	6
		Max	12
		Median	10

Table S2: Trust and equity attitudes

Community trust index	Numeric variable representing the weighted factor scores from three measures of trust among local communities; figure S1; Cronbach's alpha* =0.70, the one-factor solution explained 45% of the total variance)	Min	-2.63
		Max	0.90
		Median	0.14
Trust towards I	Numeric variable indicating farmer trust attitudes towards the Scottish National heritage I (figure S1)	mean	-0.86
		sd	1.20
		median	-1.00
Trust towards RSPB	Numeric variable indicating farmer trust attitudes towards the Royal Society for the Protection of Birds (RSPB) (figure S1)	mean	-1.38
		sd	0.94
		median	-2.00
Trust towards SGRPID	Numeric variable indicating farmer trust attitudes towards the Scottish Government, Rural Payments & Inspections Directorate (SGRPID) (figure S1)	mean	-0.44
		sd	1.24
		median	-1.00
Trust towards NFU	Numeric variable indicating farmer trust attitudes towards the National Forest Union (NFU) (figure S1)	mean	0.94
		sd	1.20
		median	1.00
Equity attitude 1: Distribution	Numeric variable indicating perceived equity of government policy (whether the current goose management scheme fairly balances agricultural and conservation interests) (figure S1)	mean	-0.47
		sd	1.27
		median	-1.00
Equity attitude 2: Distribution and recognition	Numeric variable indicating perceived equity of the allocation of goose management finances across Scotland (figure S1)	mean	-0.83
		sd	1.24
		median	-1.00

Equity attitude 3: Procedure	Numeric variable indicating perceived equity with regard to full and effective participation in decision-making related to goose management and farming (figure S1)	mean	-1.10
		sd	0.99
		median	-1.00
Equity attitude 4: Recognition	Numeric variable indicating perceived equity with regard to respect of own cultures and traditions regarding goose management (figure S1)	mean	-0.54
		sd	1.22
		median	-1.00
Attitudes towards management options	Numeric variable representing the weighted factor scores from three measures of farmers' attitudes towards the licensed sale of goose meat (figure S2, Cronbach's alpha* =0.76, the one-factor solution explained 56% of the total variance)	Min	-1.89
		Max	1.00
		Median	0.27
	Numeric variable representing the weighted factor scores from three measures of farmers' attitudes towards birdwatching/Wildlife tourism (figure S2, Cronbach's alpha* =0.80, the one-factor solution explained 62% of the total variance)	Min	-0.72
		Max	2.93
		Median	-0.65
	Numeric variable representing the weighted factor scores from three measures of farmers' attitudes towards sport shooting (figure S2, Cronbach's alpha* =0.83, the one-factor solution explained 65% of the total variance)	Min	-2.13
		Max	1.09
		Median	0.29

Table S3a: Factor loading of the interpersonal community trust indices

	One-factor solution
"Most of the time, people in my community are mostly trying to help each other"	0.61
"Generally speaking, most people in my community are honest and can be trusted"	0.84
Most people would try to take advantage of me if they got a chance.	0.50
Proportion of variance explained = 0.45, Cronbach's alpha = 0.70	
SS loadings = 1.30, Correlation of (regression) scores with factors = 0.87, Root mean square of the residuals = 0	

Table S3b: Factor loading of attitudes towards sale of goose meat

	One-factor solution
Acceptability of sale of goose meat	0.60
Effectiveness of sale of goose meat	0.61
Sustainability of sale of goose meat	0.96
Proportion of variance explained = 0.56, Cronbach's alpha = 0.76	
SS loadings = 1.67, Correlation of (regression) scores with factors 0.97, Root mean square of residuals (RMSE) = 0	

Table S3c: Factor loading of attitudes towards sale of bird watching / wildlife tourism

	One-factor solution
Acceptability of wildlife tourism	0.61
Effectiveness of wildlife tourism	0.98
Sustainability of wildlife tourism	0.72
Proportion of variance explained = 0.62, Cronbach's alpha* = 0.80	
SS loadings = 1.86, Correlation of (regression) scores with factors = 0.98, Root mean square of residuals (RMSE) = 0	

Table S3d: Factor loading of attitudes towards sale of sport shooting

	One-factor solution
Acceptability of sport shooting	0.63
Effectiveness of sport shooting	0.96
Sustainability of sport shooting	0.80
Proportion of variance explained = 0.65, Cronbach's alpha* = 0.83	
SS loadings = 1.95, Correlation of (regression) scores with factors = 0.97, Root mean square of residuals (RMSE) = 0	

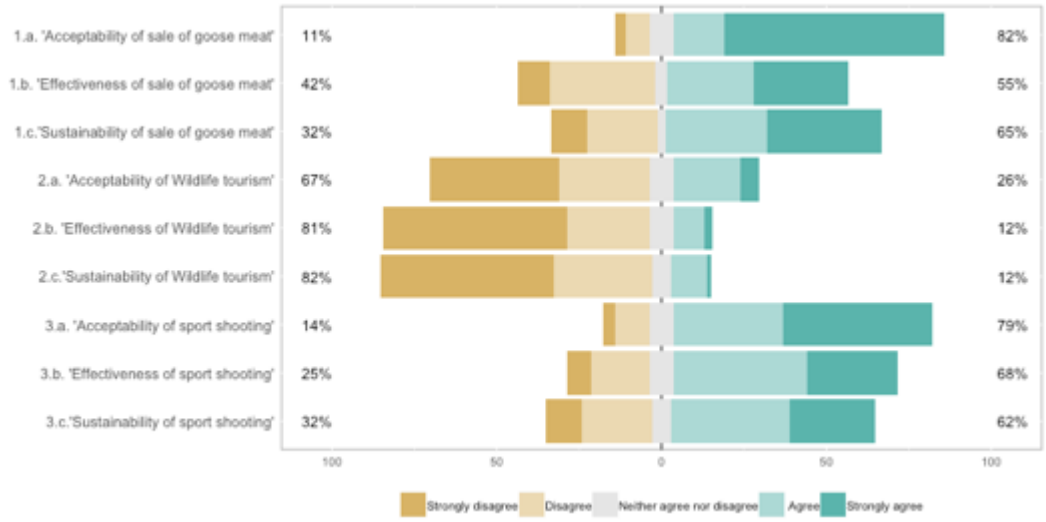

Figure S1: Participants' rated acceptability, effectiveness and sustainability of three management options with regard to mitigating the goose-agricultural conflict (licenced sale of goose meat, wildlife or bird watching tourism and sport shooting)

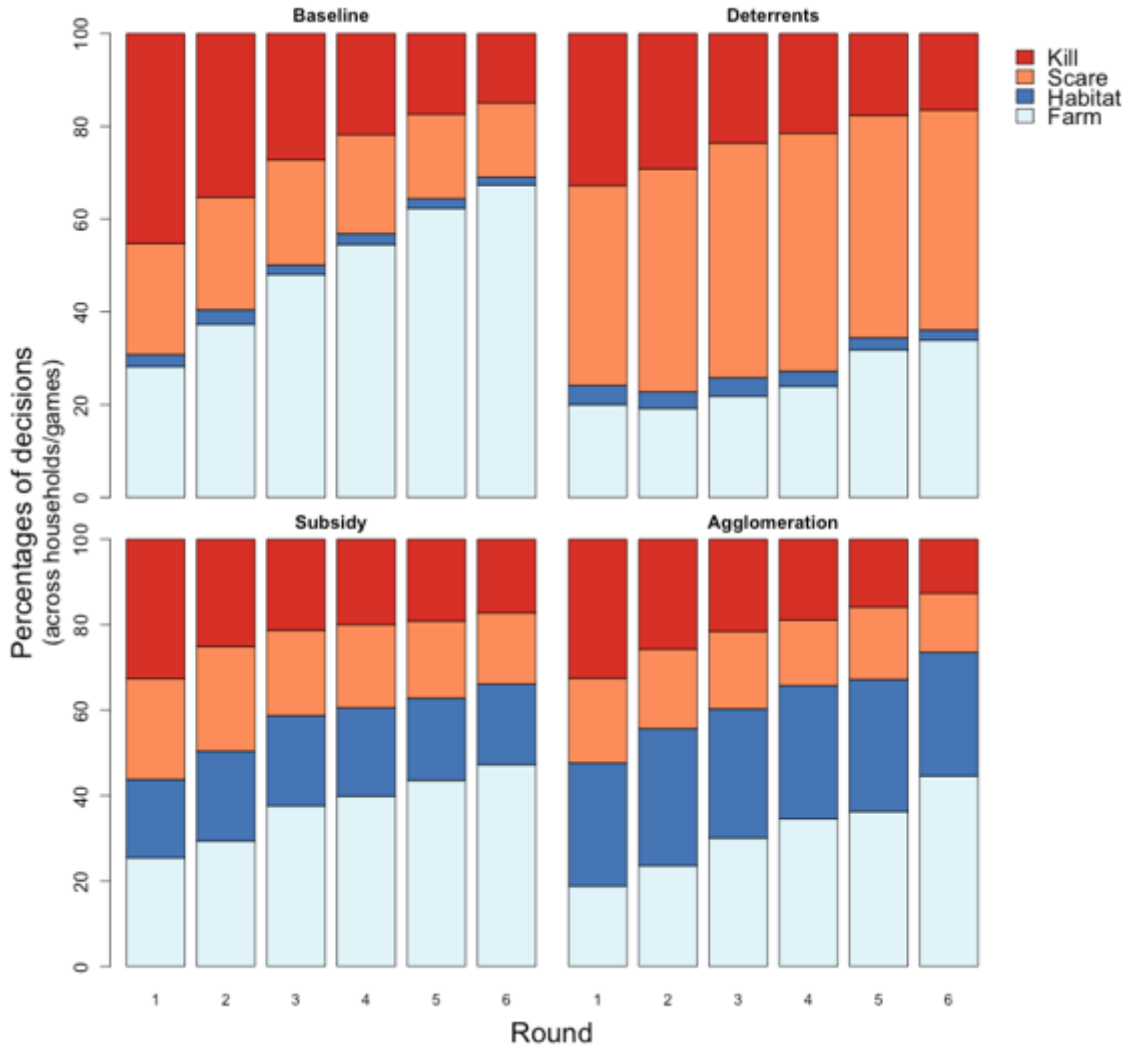

Figure S2: Distribution of observed percentages of all four decisions across treatments and rounds

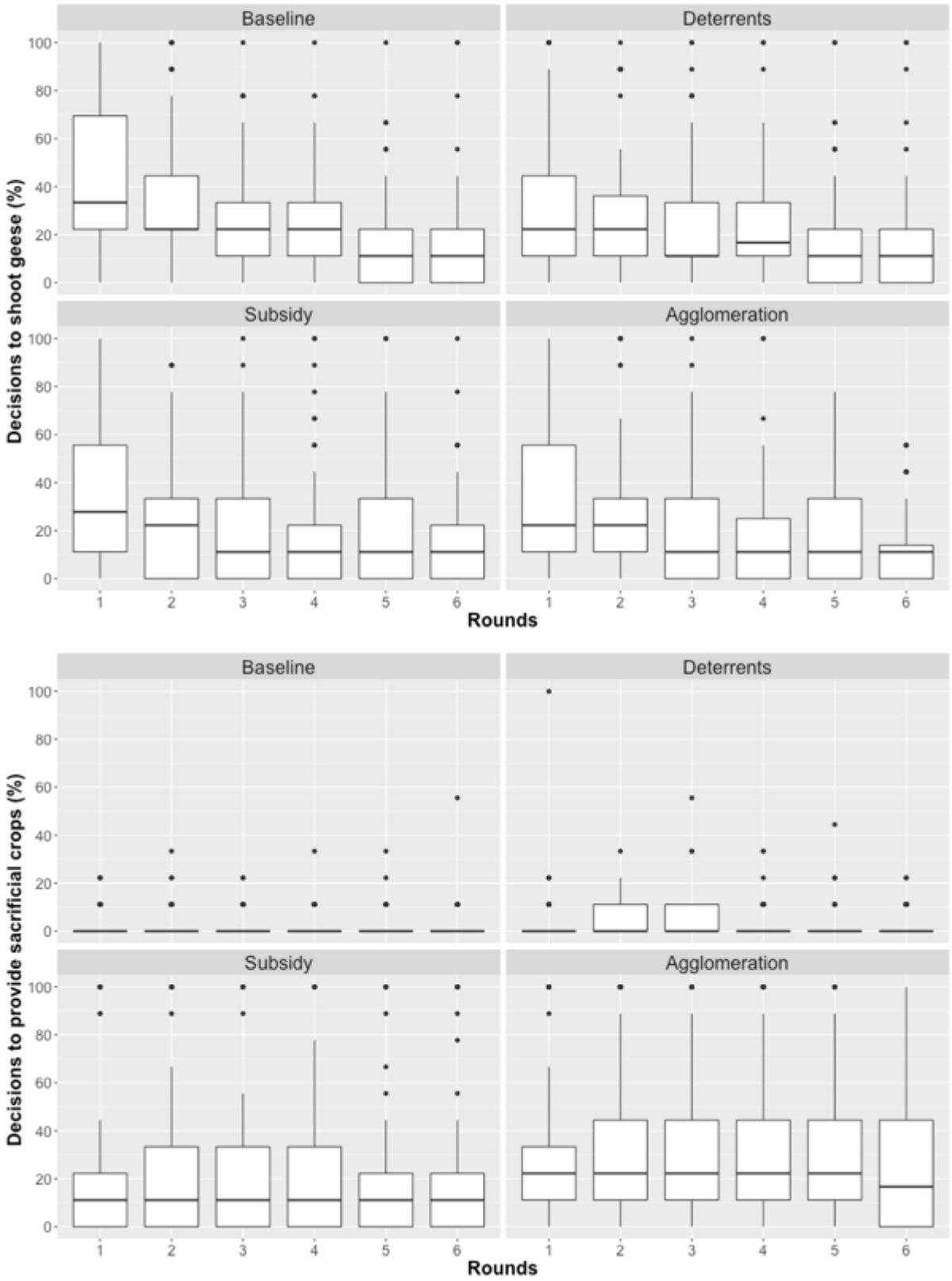

Figure S3: Distribution of observed percentages of decisions to shoot geese and to provide sacrificial crops in each treatment and round, across households and groups.

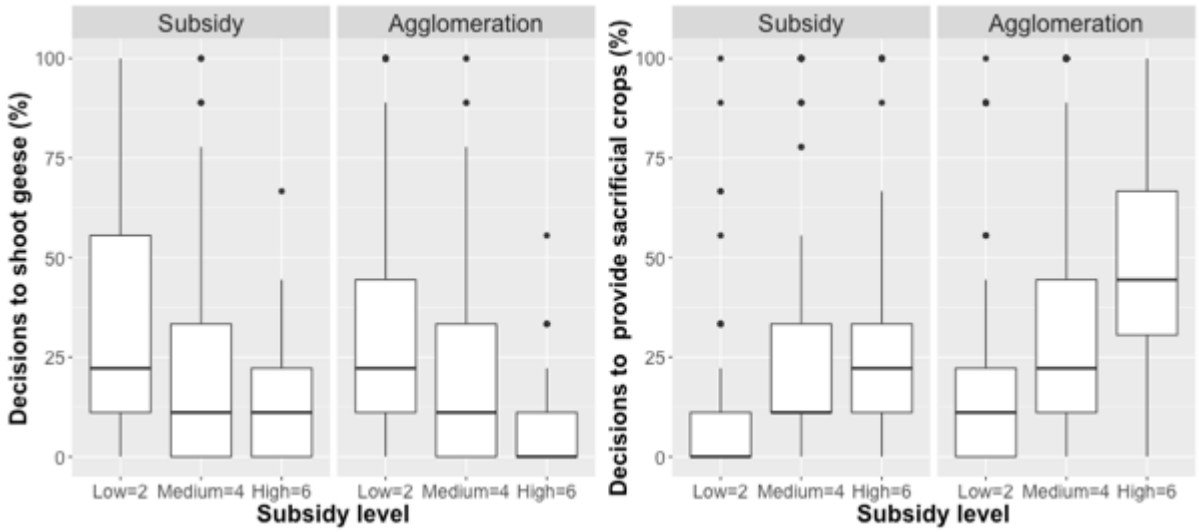

Figure S4: Distribution of observed percentages of decisions to kill and to provide sacrificial crops per subsidy level across households and groups (only observations from the subsidy and agglomeration treatments are included here).

Appendix A: Game protocol

[First set up the seating, preferably forming a circle, ask participants to read information sheet and consent form, record participants' name ID, write their identifier codes on the score recording sheet, set up tablets, and put in player identifier]
Hello, and thank you for being here today.

Today we are going to play a game about land use decision making. You'll play in groups of four, and each player will have an equal share of the land in the game, a total of 9 squares. Your participation is voluntary, but we would really appreciate if you stay for the full session as the game can't run without all four participants. The games and the accompanying questionnaire should take about 60-90 minutes.

Do you consent to continue? If at any time you find that this is something that you do not wish to participate in for any reason, you are of course free to leave whether we have started the game or not.

In each of those squares, you can do one of four things:

1 2 3 4

1. Farm the square for private business

2. Farm the square for private business and scare geese away using scaring techniques (includes shooting as a method to scare geese away)

3. farm the square for private business and shoot geese to reduce their numbers

4. Provide disturbance free feeding areas for geese (goose habitats)

Each of the you will take responsibility for land use decisions on a 3x3 grid-cell section (farm) of a 6 x 6 grid-cell agricultural landscape as shown in the following figure. The white coloured number on each square is the number of geese (figure 1).

Each of these four options has different benefits and costs. Let me introduce each of them in turn.

Farming the square (options 1, 2 and 3) brings a yield of +4. Providing goose habitats brings no yield. scaring brings a cost of -1 while shooting -2.

We are going to play a few rounds per game session – rounds can be analogous to years. In each round, there are a certain number of geese in the landscape. When geese land on farmed cells (options 1, 2, 3), they cause damages and decrease your farm yield. This is described in the second line in the above figure ("goose damage"), the amount of goose damage on each farmed square depends on the number of geese in that square.

You don't need to memorize this – you can use this sheet as a reference while you play the game [hand out sheet now].

At the start of each round, geese decide where to land based on the "attractiveness" of the four options. Goose habitats (the fourth option) is the most attractive option, that is geese are much more likely to be drawn to a goose square (option 1) than on lands farmed for private business (options 1, 2, 3). Therefore, goose habitats can reduce agricultural damages across the landscape by drawing geese from other places. However, goose habitats may increase the amount of goose damage in farmlands that immediately surround them by bringing more geese close to them in the landscape. Put simply, goose habitats may make things better for some farms but worse for really close farms.

Now, if you decide to scare geese on a given cell, then some geese will leave the cell and reorient in other cells. The number of geese at the start of each round varies with shooting efforts and the goose population growth rate (the more you shoot, the less geese there are).

In some of the game sessions that we are going to play today, a subsidy and/or bonus is given for every goose habitat in the landscape. In another game session, the subsidy will offset the cost of the scaring technique, i.e. the cost of the scaring option (option 2) becomes zero.

You can cycle through the choices for each square by clicking on the square itself, and we'll practice that in a minute. When you've decided, you can click 'Confirm' and wait for the other players to confirm. Once everyone has confirmed, the round is over and the "score" (i.e., the total points earned) is calculated for each cell based on your choices in and around the cell, and the process is repeated in the next round.
You will make decisions simultaneously on your land squares and will see at the end of each round what has happened across the whole landscape, what yields are achieved in each square, and what score is earned by each player.
One other note – you can change any of the 9 squares to any of the two land use choices you like, in each round.

So just to review –Farming brings a yield of +4. Scaring techniques bring a cost of -1 and shooting costs -2. Goose habitats bring no yield, but they may decrease goose damage across the landscape by keeping geese away from farmlands. However, farmlands that are directly surrounding these goose habitats may attract more geese and hence be negatively impacted.

Let's look now at the game screen and see how this all fits together.

This is a screen shot from the first turn for Player 1, in the bottom left quadrant. The identifiers of the other three players are shown over their quadrants, which are lighter in colour, and can't be modified by Player 1.

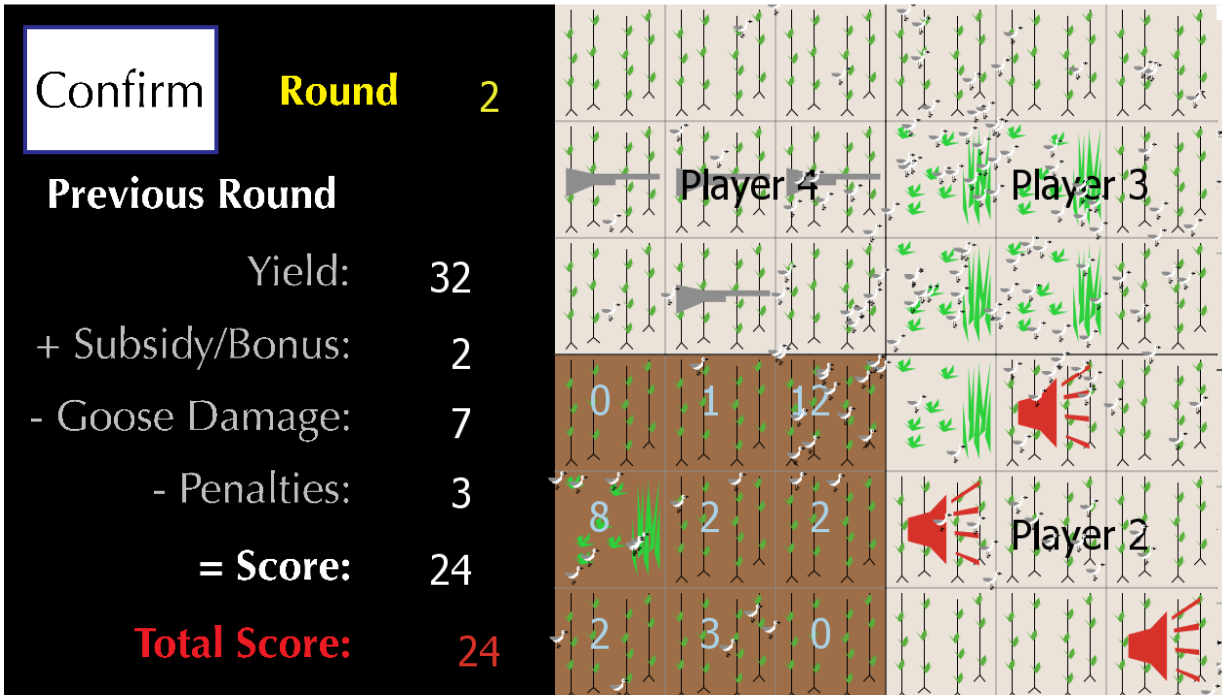

Figure 1: Bottom left corner of the landscape is active player, actions taken by other players in previous turn are visible. The white coloured number on each square is the number of geese. The scores of the active player in previous round is shown in the left-hand side of the panel.

After I have finished the explanation, we will play a short practice game to help you to understand the process.

PRACTICE [GP]

We'll just play a few short rounds now so that you get comfortable with the rules of the game. I'll walk you through the first turn so you can see how it goes, and you can ask me questions during your turn or between rounds. I encourage you to use the practice session as an opportunity to explore different options and see what happens. Feel free to discuss with others, but please do keep your screen to yourself.

[walk through a 5-round practice game]

Got it? *[answer any follow-up questions]*

Ok, let's move on to the experiment.

We are going to play four different games [the order will be randomised across groups], each one of which will differ a little bit, and might change a bit from what we've done in the practice.

Now, as you make your decisions, we'd like you to maximize your utility (or to do well) by trying to earn points. Please remember that there are different ways to earn points, either by playing individually or as a team working together. Most importantly, we want your decisions to reflect what you would do in real life.
Ok, let's begin.

[Each game group will play four treatments – the order being randomised. Thus, the four treatments can be introduced in a way that does not depend on other treatments having been played first]

T1: Baseline

In this game, the settings are just like they were in the practice. There is no subsidy from providing goose habitats. You are allowed to discuss the game with the other players for about one-minute at the

beginning of each round, but please keep your screen to yourself. This game will last at least 6 rounds.

T2: Flat rate subsidy: a subsidy *X* is drawn randomly at the beginning of the game and held constant during the game

In this game, you are being offered a subsidy for each square of goose habitat in your land. You'll receive a subsidy which will add to your total score. You are free to discuss the game with other players for about one-minute at the beginning of each round but keep your screen to yourself. This game will last at least 6 rounds.

T3: Scaring support:

In this game, the settings are just like they were in the practice. There is no subsidy from providing goose habitats. However, you will get some financial support with the use of non-lethal scaring techniques, the support will offset the cost of -1, i.e. the cost of the non-lethal scaring techniques becomes zero. You are allowed to discuss the game with the other players for about one-minute at the beginning of each round, but please keep your screen to yourself. This game will last at least 6 rounds.

T4: Agglomeration Bonus - Using same subsidy level as in T2

In this game, you are being offered a subsidy for each square of goose habitat in your land. You'll receive a subsidy which will add to your total score. In addition, you will also get an additional bonus of 1 point for every goose square that has at least one goose square next to it. You are free to discuss the game with other players for about one-minute at the beginning of each round but keep your screen to yourself. This game will last at least 6 rounds.