

**SFMN Incentives Project Research Report:**

**Joint Management of Forest Ecosystems**

Elizabeth A. Wilman

Hamed Kaddoura

Leo Amorim

and

Irving Rosales

Department of Economics  
University of Calgary

December 2008

## Introduction

Transferable Development Permits (TDP's) are often recommended as a cost effective way to preserve biodiversity or wildlife habitat in the presence of development pressure Weber and Adamowicz (2002). However, the spatial pattern of preserved habitat may be equally as important as the quantity. Unless trade is restricted, or TDP's are supplemented by some other incentive mechanism, the spatial pattern of protection will not necessarily be optimal.

The purpose of this research is to introduce a payment incentive mechanism to supplement TDP's and produce spatial optimality. Both the TPD's and the supplementary payment mechanism are tested in a laboratory setting using students from the University of Calgary.<sup>1</sup>

The results show that it is possible to use a payment mechanism to consistently produce a wildlife corridor. However, there are a number of areas in which more work needs to be done to refine the approach.

## Review of the Literature

The problem addressed in this research is essentially a coordination problem, similar to the one investigated by Parkhurst *et.al.* (2002), and Parkhurst and Shrogen (2007). In an experimental setting, in which landowners/agents were being paid to set aside land for conservation purposes, Parkhurst *et.al.* (2002) introduced an agglomeration bonus for players setting aside contiguous plots in certain spatial arrangements. An agent's payoff depended partly on other agents' choices. The experiment was static in that there was only one decision point. The agglomeration bonus worked well in a static environment, particularly with preplay communication.

---

<sup>1</sup> Appendix I provides some data on the subjects.

A related literature exists in the use of incentive mechanisms for the control of non-point source pollution. The problem with non-point source pollution is that an individual agent's emissions cannot be observed. Hence, instruments such as a group fine, which has each agent pay a tax based on an aggregate measure of ambient environmental quality, are used. The overall tax paid by an agent will depend on the pollution caused by all agents. Much of the experimental literature in this area has been based on a non-cooperative model with no communication among agents. This was largely because the theory was based on such a model (Segerson, 1998). However, recently there have been a couple of papers that have introduced communication and cooperation. Vossler *et.al.* (2006), tested two instruments with and without communication: a fixed group fine and a marginal tax-subsidy instrument. With communication, agents were able to coordinate their actions to keep the aggregate pollution just under the level at which the fixed fine would be applied. Without communication, pollution frequently exceeded the standard. However, for the marginal tax/subsidy instrument, the marginal tax paid by each agent is not affected by the actions of other agents, but over compliance resulted from collusion in the output market.

Suter *et.al.* (2008) also introduce communication. They use a fixed, competitive market price. When firms cannot collude to influence price, Suter *et.al.* are able to characterize ideal communication as "harnessing the power of cooperation with the objective of achieving the social optimum. . ." (p. 99). They go on to suggest that the regulator can treat the regulation problem as one in which the regulator is effectively regulating only one agent-the group of polluters. They consider both a linear and a non-linear tax (e.g. fixed fine) and find the following.

By imposing a tax on each firm that is equivalent to the level of the linear or non-linear tax divided by the number of polluting firms, we find that efficiency approaches 100% (p. 101).

### TDP's with a Payment for Wildlife Corridors

Our work differs somewhat from both Parkhurst *et.al.* and the non-point source literature. The problem is one of coordination in a dynamic framework. Earlier work, which was part of this project, investigated the dynamic aspects of this problem with a single landowner (Perger, 2006). The current research maintains the dynamic framework, but adds the dimension of multiple landowners. A large forested area is made up of a set of plots owned (or under longterm lease) and managed by different private forest managers. There are two possible ages for the stand of trees on the plot, young and mature. Forest harvested in the current time period will be young in the next time period, and, if not harvested, will grow to be mature within two time periods. The goal is to maintain a specified number of hectares as mature forest, with some of this mature forest being spatially arranged as a wildlife corridor. Harvesting timber is assumed to be the only possible development activity. The first part of this goal is achieved by issuing a limited number of tradable development permits. The second is achieved through the regulator paying a group of three plot owners to enter into a contract to provide a wildlife corridor consisting of a column of three plots of mature forest. The payment is determined either through a reverse auction with a pre-specified split of the winning bid among group members, or through a pre-specified payment, with group members negotiating the split of that payment. In all but one treatment there is a \$40 penalty if an awarded contract is not honoured.

In the auction literature, joint bidding has a positive and a negative aspect. The positive aspect reflects complementarities among bidders in procurement auctions. The negative aspect is the potential for collusion and bid rigging (Klemperer, 2002). Our focus is on complementarities, with cooperation being required to produce a wildlife corridor. There is little evidence of collusion, as winning bids tend to be close to minimum bids.

Since harvested timber is sold on a perfectly competitive market, there is no possibility of collusion to restrict output (harvested timber) and raise output. Plot owners have the goal of maximizing their individual profit, where profit can come from harvesting timber, selling a harvest permit, or being part of a group that obtains a contract to provide a wildlife corridor. In these experiments communication plays the same role as in Suter *et.al.*: it facilitates achievement of the social optimum.

### The Greater Forest Landscape

The greater forest landscape at the beginning of the initial time period appears as is shown below. There are eighteen plots, all containing mature forest. The harvest value of the middle row of plots is \$35. The harvest value of plots in the third and fourth columns and the first and third rows is \$30. The remaining plots have a harvest value of \$25. Six harvest permits are allocated randomly in each of six rounds.<sup>2</sup>

First consider the optimal harvest plan. In the absence of any demand by the regulator for a wildlife corridor, the initial round after-trade allocation of the permits would be to the middle row where they generate the most harvest value. These plots are then harvested, generating a total harvest value of \$210 for the round. At the beginning of the second round all plots harvested in the initial round will contain immature forest. The harvest value of immature plots is \$10. Harvest permits are again allocated randomly, and the after trade allocation should see four permits go to mature forest plots with a \$30 harvest value and two permits to mature forest plots with a \$25 harvest value. The total harvest value in this round is \$170. In the third round the after trade allocation will again go to the middle row, and in the fourth round to four \$30 plots and two \$25 plots. This after trade allocation and harvest pattern repeats for the fifth and sixth rounds. At the

---

<sup>2</sup> In some experiments the number of plots was reduced to 15 or 12. The 12 plot landscape was achieved by removing the far right and far left columns; the 15 plot landscape by adding a middle column to the 12 plot landscape, with the middle column having the same harvest values as those on either side of it. With 15 plots 5 harvest permits were initially allocated, and with 12 plots 4 harvest permits were initially allocated.

beginning of the seventh round the land is sold to the regulator, with the sale price paid to the plot owner being larger for mature forest than for immature forest. The maximum aggregate value (private and social) that can be generated is three rounds of \$210, three rounds of \$170, plus the final sale value or  $\$630 + \$510 + \$1201 = \$2341$ .

### The Greater Forest Landscape at the Beginning of the Initial Round

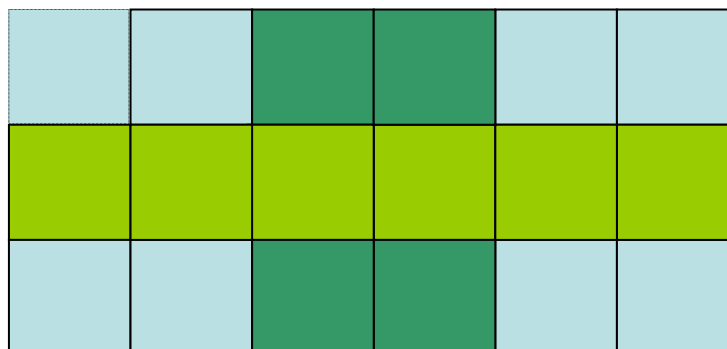


A potential corridor is a mature column in the current time period that is maintained for an additional time period.

---

### The Greater Forest Landscape at the Beginning of the Second Round

#### Given an Ideal Harvest Pattern in Initial Round



A wildlife corridor is defined to be any column (three plots) of mature forest. Assuming the wildlife corridor has a social value (or value to the regulator) of \$100 every round, the maximum social value can now be obtained by harvesting five \$35 plots in the first round, and one \$30 plot. In the second round three \$30 plots and three \$25 plots should be harvested. As in the case without the corridor, the third and fourth rounds are repeats of the first and second, as are the fifth and sixth. Again the land is sold to the regulator at the beginning of the seventh round. The harvest value for the first, third and fifth rounds is \$205, including a corridor value of \$100. For the second, fourth and sixth rounds, the harvest value is \$165, including a corridor value of \$100. The final sale value is \$1215. The maximum value the land can generate is  $\$615 + \$495 + \$600 + \$1215 = \$2925$ . The net gain from the corridor is \$584. This is \$600 minus \$26 in lost harvest value.

### Baseline Results

The baseline treatment involved only initial permit allocation and trading. Permits could be bought/sold only once per round. They were traded in a double auction at prices set via bilateral transactions. Most of the baseline treatments were done with 18 plots/subjects. However, a number were done with 15 or 12 plots.<sup>3</sup>

Table 1 below shows the results for the baseline treatments. Trading resulted in 0.89 to 0.98 of the maximum value being obtained in the treatments. On average 0.94 of the maximum value was obtained with a standard deviation of 0.03. Had trading produced the maximum profits, no wildlife corridors would have been produced. One of the side effects of inefficient trading is that wildlife corridors are produced inadvertently. Out of eleven baseline treatments, six produced a corridor over all six rounds of the treatment, and five did not.

---

<sup>3</sup> Appendix III gives the instructions for the baseline treatments, ascending and descending auctions, and the negotiated split treatments. Instructions for the sealed bid auction are not included, but they are similar to the other two auctions.

<b>Table 1: Profits Generated in Baseline Experiments</b>											
<b>Actual Profit</b>			<b>Optimal Profit</b>				<b>Fraction of Optimal Profit</b>				
No. Plots	Harvest	Land Sale	Total	Harvest	Land Sale	Total	Harvest	Land Sale	Total	Harvest	Total
18	870	1224	2094	1140	1201	2341	0.76	1.02	0.89	0.89	0.89
18	975	1119	2094	1140	1201	2341	0.86	0.93	0.89	0.89	0.89
15	910	1039	1949	975	1029	2004	0.93	1.01	0.97	0.97	0.97
15	935	1033	1968	975	1029	2004	0.96	1	0.98	0.98	0.98
12	750	810	1560	780	814	1594	0.96	1	0.98	0.98	0.98
12	715	816	1531	780	814	1594	0.92	1	0.96	0.96	0.96
18	950	1227	2177	1140	1201	2341	0.83	1.02	0.93	0.93	0.93
12	620	831	1451	780	814	1594	0.79	1.02	0.91	0.91	0.91
18	975	1221	2196	1140	1201	2341	0.86	1.02	0.94	0.94	0.94
12	655	816	1471	780	814	1594	0.84	1	0.92	0.92	0.92
18	980	1230	2210	1140	1201	2341	0.86	1.02	0.94	0.94	0.94
										Mean	0.87
										SD	0.07
											1
											0.03
											0.03



## The Contract for the Wildlife Corridor

The main objective of the experiments was to supplement the TDP's with a wildlife corridor contract to ensure that one column of mature forest was available as a wildlife corridor through the greater forest landscape at all times. Four different versions of the corridor contract were used.

- An increasing price reverse auction with the winning bid split among group members according to the relative mature harvest values of the land.
- A sealed bid reverse auction with the lowest bid as the winning bid, and the winning bid split among group members according to the relative mature harvest values of the land.
- A declining price reverse auction with the winning bid split among group members according to the relative mature harvest values of the land.
- A fixed price contract of \$100, with a negotiated split among group members. A default split, according to relative harvest values, was provided.

## Reverse Auctions

The reverse auction was used because what is being auctioned is a procurement contract. The regulator wishes to contract with a group of forest plot owners for the provision of the corridor. A crucial aspect of the reverse auctions was the bid range. One might typically think of the purchaser specifying only an upper limit reservation price. However, a feature of common value auctions is the *winner's curse*. In procurement auctions a naïve and imperfectly informed bidder is overly optimistic about her cost of supplying the product, and underbids to win the contract (Hong and Shum, 2002). This is likely to lead to the winner defaulting on the contract. To avoid the winner's curse we specified a minimum bid. In the first ascending auction treatment, this was not sufficient to avoid defaulting, and no corridors were successfully formed. For the remaining treatments a penalty for default was added.

Three types of auctions were used: an increasing price auction, a sealed bid auction, and a decreasing price auction. The increasing bid auction began at \$60 and increased in \$5 increments. The winning bidder was the first bidder. The sealed bid auction allowed prices of between \$50 and \$150 to be submitted, with the winner being the lowest bidder. The descending price auction started at \$110 and decreased in increments of \$5 to a minimum bid of \$40. The winning bid was the price at which the last bidder to exit the auction. With the exception of the first ascending price auction, in which no contracts were both awarded and honoured, there was a \$40 penalty for not honouring an awarded contract.

The results of the auction experiments are shown in Tables 2 and 3. Table 2 shows the number of contracts awarded and the winning bids. The least successful treatment was the first ascending auction treatment, in which the only penalty for defaulting on the contract was the loss of the payment. In all other treatments there was an additional penalty of \$40 for defaulting. The other case in which the contracts were defaulted upon was the sealed bid auction. In this case there was a penalty, so it is more difficult to say why there were two defaults. Overall, corridors were consistently formed (a corridor in every one of six rounds) in four out of six treatments. The descending auction treatment consistently formed corridors in all three treatments even though bid prices were lower than in other auction types.<sup>4</sup>

Table 3 shows the private profits plus the social value of the corridor generated relative to the optimal case. It is assumed each corridor has a social value (or value to the regulator) of \$100. This number was often cited in the experiment instructions as an example of a bid price, although it was never explicitly stated that the corridor was worth \$100 to the regulator. The treatments generated between 0.79 and 0.92 of the maximum possible social value. On average 0.86 of the maximum value was obtained with a standard deviation of 0.06. The average is less than that for the baseline experiments and the standard deviation is greater. This is partly because of the treatments in which corridor formation was not always achieved. However, it also reflects the fact that in cases in

---

<sup>4</sup> Appendix II provides an example of communication among group members choosing a bid amount.

which corridors were successfully formed in all rounds, a greater than necessary amount of harvesting revenue was forgone in attempts to form the corridor. Groups, who did not win the contract in one round, left their land unharvested in anticipation of winning the contract in the next round.

Table 4 shows the profits in the auction treatments relative to the average baseline profit for different landscapes. The treatments varied considerably with respect to how greatly profits from harvesting plus contracts increased relative to baseline profits (from harvesting alone). On average the former were 1.12 of the latter, with a standard deviation of 0.17. Including land sale profits reduced the profit differential as well as the variation. Overall profit, including contract payments, was on average 1.06 of baseline profit with a standard deviation of 0.07. The null hypothesis that the ratio of auction treatment profits to baseline profits is unity was rejected with a 0.05 level of significance, but not with a 0.01 level of significance ( $t=2.1$ ).

#### Fixed Payment with a Negotiated Split

The final version of the payment for the corridor was a fixed \$100 payment per corridor, with group members negotiating how this payment would be split among the three of them. Table 5, 6 and 7 show the results of these treatments. Table 5 shows the contracts awarded, shares, and penalties for the negotiation treatments. Although the payment was higher than the winning bid in any of the auctions, there were still defaults. In only one of the treatments was a corridor successfully formed in all of six rounds. In contrast, all three of the descending auction treatments successful formed six corridors, despite the fact that the winning bids were around half of the fixed payment (\$40 to \$50 compared to \$100). The negotiation itself may be what causes subjects to default on the contract. A successful strategy for one group was to avoid negotiation and simply use the default split provided.<sup>5</sup>

---

<sup>5</sup> Appendix II provides two examples of communication. In the first example group members are frustrated in their attempts to negotiate a split. In the second, group members have chosen to use the default split provided.

**Table 2: Winning Bids and Penalties in Auction Experiments**

No. Plots	Contracts	Winning Bids	Penalties
Ascending Auction			
18	3	No	No
18	6	60	60
Sealed Bid			
15	6	50	50
Descending Auction			
18	6	60	60
12	6	45	45
18	6	50	50

**Table 3: Profits + Corridor Value Generated in Auction Experiments**

Actual Profit No. Plots	Harvest	Corridor Value*		Payment to Group	Total Social Value	Optimal Profit		Corridor Value*	Total Social Value	Fraction of Harvest	Fraction of Optimal Profit Land Sale	Fraction of Corridor Value	Fraction of Total Social Value
		Land Sale	Harvest			Land Sale	Harvest						
Ascending Auction													
18	930	1224	200	79	2354	1110	1204	600	2914	0.84	1.02	0.33	0.81
18	940	1196	600	360	2736	1110	1204	600	2914	0.85	0.99	1	0.94
Sealed Bid													
15	635	1043	400	138	2078	960	1070	600	2630	0.66	0.97	0.67	0.79
Descending Auction													
18	745	1221	600	295	2566	1110	1204	600	2914	0.67	1.01	1	0.88
12	325	849	600	305	1774	750	816	600	2166	0.43	1.04	1	0.82
18	890	1199	600	260	2689	1110	1204	600	2914	0.8	1	1	0.92
* Each corridor formed has a value of \$100.													

<b>Table 4: Profits Generated in Auction Experiments Relative to Mean Baseline</b>											
<b>Actual Profit</b>		<b>Mean Baseline Profits</b>						<b>Fraction of Mean Baseline Profit</b>			
No. Plots	Harvest	Contracts	Land Sale	Total	Harvest	Land Sale	Total	Harvest + Contracts	Land Sale	Total	
<b>Ascending Auction</b>											
18	930	185	1224	2339	950	1204	2154	1.17	1.02	1.09	
18	940	360	1196	2496	950	1204	2154	1.37	0.99	1.16	
<b>Sealed Bid</b>											
15	635	243	1043	1921	923	1036	1959	0.95	1.01	0.98	
<b>Descending Auction</b>											
18	745	290	1221	2256	950	1204	2154	1.09	1.01	1.05	
12	325	305	849	1479	685	824	1509	0.92	1.03	0.98	
18	900	260	1199	2359	950	1204	2154	1.22	1	1.1	
							Mean	1.12	1.01	1.06	
							SD	0.17	0.01	0.07	

Table 6 shows the actual harvest profits, land sale values and social corridor values as a fraction of their optimal values. On average, harvest profit was 0.69 of optimal harvest profit with a standard deviation of 0.06; land sale profits, 0.91 of the optimal value with a standard deviation of 0.15; social corridor values, 0.7 of the optimal value with a standard deviation of 0.4; and the total social value was 0.79 of the optimal value with a standard deviation of 0.09. This compares with 0.86 with a standard deviation of 0.06 for the auction treatments, but the difference is not statistically significantly different from zero at the 0.05 level of significance ( $t=1.54$ ).

Table 7 compares the actual harvest profits, contract profits and land sale profits with the average harvest and land sale values for the baseline case. On average, the harvest plus contract profits are 1.35 of average baseline profits, with a standard deviation of 0.29. The land sale profits are 0.95 of the baseline value, with a standard deviation of 0.08, and the total profits are 1.13 of the baseline, with a standard deviation of 0.12. For the auction case the total profit was on average 1.06 of the baseline, with a standard deviation of 0.07. Both mean ratios are statistically different from unity with a 0.05 level of significance ( $t=2.54$  and  $t=2.1$  respectively). Again the difference between the mean ratios is not statistically different from zero other at that level of significance ( $t=1.21$ )

### Evaluation of Results and Directions for Future Research

There is evidence that, in a framework in which communication facilitates cooperation, the supplemental payment mechanism can lead to consistent corridor formation. In particular, the descending auction treatment produced consistent corridors over all three treatments. There does appear to be a winner's curse. However, a minimum bid, combined with a penalty for defaulting, corrected this problem. Pre-specifying the split of the payment seemed to work better than having the plot owners negotiate the split. This is despite the fact the winning bids in the auction were usually low.

Although the descending auction treatment looks promising, the testing has not been complete enough to say that it is superior. Nor is it clear what the minimum bid amount should be, or how high the penalty must be to avoid default. Further testing is necessary to determine how best to deal with winner's curse/ default issues.

In this set of experiments, group members were not required to decide both the amount of the group bid and the split of that bid. One or the other was always fixed. Negotiation of the split seemed to be most problematic. Group member found there negotiations frustrating. A successful strategy for one group was to use the default split, based on relative harvest values that was provided. Experiments should be run, which combine bid choosing and split negotiation, but it is probably necessary to provide a default split to lessen frustration.

Finally, the experiments to date have been run using undergraduate university student as subjects. Testing on forestry professionals would be desirable.





**Table 7: Profits Generated in Negotiation Experiments Relative to Mean Baseline Actual Profit**

No. Plots	Actual Profit			Mean Baseline Profits			Fraction of Mean Baseline Profit			
	Harvest	Land Sale	Total	Harvest	Land Sale	Total	Harvest+	Land Sale	Total	
18	840	0	1233	2073	950	1204	2154	0.88	1.02	0.96
18	780	500	1040	2320	950	1204	2154	1.35	0.86	1.08
12	520	600	814	1934	685	824	1509	1.64	0.99	1.28
12	565	500	712	1777	685	824	1509	1.55	0.86	1.18
18	765	500	1218	2483	950	1204	2154	1.33	1.01	1.15
							Mean	1.35	0.95	1.13
							SD	0.29	0.08	0.12

## References

- Hong, H. and M. Shum. 2002. Increasing Competition and Winner's Curse: Evidence from Procurement." *Review of Economic Studies* 69(4): 871-898.
- Klemperer, P. 2002. "What Really Matters in Auction Design." *Journal of Economic Perspectives* 16(1): 169-189.
- Parkhurst, G.M., Shogren J.F., Bastian, C. Kivi, P., Donner, J. and Smith, R.B.W. 2002. "Agglomeration Bonus: An Incentive Mechanism to Reunite Fragmented Habitat for Biodiversity Conservation." *Ecological Economics* 41: 305-328.
- Parkhurst, G.M., Shogren J.F. 2006. "Spatial Incentives to Coordinate Habitat." *Ecological Economics* 64: 344-355.
- Perger, Orsolya. 2006. *Spatial and Temporal Forest Management*. M.A. Thesis (Economics).
- Segerson, K. 1988. "Uncertainty and Incentives for Non-Point Source Pollution." *Journal of Environmental Economics and Management* 15: 87-98.
- Suter, J.F., C.A. Vossler, G.L. Poe and K. Segerson. 2008. "Experiments on Damage-Based Ambient Taxes for Nonpoint Source Polluters." *American Journal of Agricultural Economics* 90(1): 86-201.
- Vossler, C.A., G.L. Poe, W.D. Schultze, and K. Segerson. 2006. "Communication and Incentive Mechanisms Based on Group Performance: An Experimental Study of Nonpoint Pollution Control." *Economic Inquiry*. 44: 599-613.
- Weber, M. and W. Adamowicz. 2002. "Tradable Land Use Rights for Cumulative Environmental Effects Management." *Canadian Public Policy* 28(4): 581-595.

### Appendix I: Data on Subjects

Subjects were register via email listing in advance of the experiment date. They were paid both for their participation and performance (\$5 for fulfilling registration and up to \$40 for performance). Experiments included two or three treatments and ran from 1.5 to 2 hours. Subjects were provided with written instructions ahead of time. A presentation of the instructions preceded the experiment, and the written instructions were also available during the experiment. In addition, subjects were allowed practice rounds to gain experience with the experiment. These were not subject to data analysis or payment. Subjects were randomly assigned to forest plots at the beginning of each treatment.

Categories	Percentages
Undergraduate U of C students	100
Female	53
Male	47
Field of Study	
Biology	9
Commerce	21
Economics	10
Engineering	12
Other Social Science/Humanities	17
Other Science	17
Other Unknown	14

## Appendix II Communications

Below are two examples of communication among members of a group, prior to bidding in an auction, or prior to volunteering for a the \$100 payment.

**EXAMPLE 1:** Descending Auction: This group lost out in the first two rounds and had the winning bid in the next four.

### **ROUND 2**

#### **Subject:**

5 hey we did not win last time  
 11 so how did it go?  
 5 shud i do 65 this time  
 i didnt get it last time.. cuz i think some other group waited until around  
 17 50  
 11 sure  
 5 ya i know  
 5 k wat do u say 65?  
 5 or 60

#### **Message:**

### **ROUND 3**

#### **Subject:**

5 we lost man  
 11 still no win  
 5 the guiy behind me i guess topped at 50  
 17 maybe we wait this time  
 11 we need to actually hold out if we want the profits  
 5 i heard his click go at 50  
 11 bah  
 5 should we go with 50  
 11 ok so we hold out to 50?  
 5 i think yes  
 17 sure 50  
 5 s17  
 17 ok lets try this  
 5 k good  
 i mean, i stand to gain if i harvest, but in the long run it's better if i don't  
 11 harvest  
 5 ya lets see  
 11 so i hope we win this time!  
 5 yup  
 5 dont harvest  
 17 yea

#### **Message:**

11 k i won't  
 5 itll be good in the last round when all ours are mature  
 11 i'll try to sell the permit  
 17 k no harvesting

#### ROUND 4

##### Subject:

##### Message:

11 awesome!  
 5 cngrats guys  
 17 yes haha  
 11 let's do that again!  
 5 shud i do 50 again  
 11 sure  
 5 are u sure  
 5 or shud i go lower  
 yea ... i heard some guy behind me clicked at  
 17 55  
 5 haha  
 5 45 or 50?  
 11 hmm...  
 5 im sure hell click on 50 this time  
 17 45 is more safe  
 11 try to hold out to 45 if need be?  
 5 k 45  
 11 nobody here has permits anyway  
 5 deal  
 17 yea haha

#### ROUND 5

##### Subject:

##### Message:

5 kahaha  
 11 great  
 11 so, let's just do that again  
 5 i seriously heard the guys klik on 50  
 17 haha  
 17 so what should we do this round?  
 5 should we do 40  
 11 40  
 17 ok 40 then  
 5 im sure hell klik on 45 this time  
 11 i think they'll wait longer this time

5 k 40deal  
 11 k  
 5 im sure we're neighbors  
 17 hahahaha  
 5 hahah  
 11 possibly?  
 5 maybe ;)  
 17 maybe  
 17 lol  
 5 cant disclose  
 5 darn  
 11 meh  
 11 good luck!  
 5 maybe last roudn haha  
 5 good luck

**EXAMPLE 2:** \$100 Payment-Negotiation Treatment: Group A was a frustrated group. Group B let the computer pick their proportions and won the corridor contract for four rounds.

### ROUND 1: GROUP A

**Subject:**

**Message:**

14 30% and I'm happy  
 14 More and I'm estatic  
 2 go for the contract  
 8 you all do not have permits

### ROUND 2: GROUP A

**Subject:**

**Message:**

14 OOKAY  
 14 WHO'S THE IDIOT  
 2 what the hell  
 14 WHO WON THE CONTRACT  
 8 no permits  
 14 AND THEN RENEGED  
 2 well yeah we all lose money  
 2 do you know what you are doing 8  
 8 no  
 and probably you most of all if you set the portion of income to yourself the  
 14 most  
 8 i give you both 30  
 2 this is very unfair  
 2 no you didn't  
 14 aah well.....

- 2 you give us 10
- 14 We can't even volunteer this round
- 14 Because ONE OF US IS YOUNG
- 2 did u even click confirm

### ROUND 3 GROUP B

**Subject:**

**Message:**

- should we just let the computer pick
- 9 our proportions?
- 3 see... we made some money
- 15 why didnt u sell your permit??
- 9 don't havest again?
- 3 don't harvest

### ROUND 4 GROUP B

**Subject:**

**Message:**

- 3 sweet, we made more money
- 9 we made money
- 9 yap
- 15 you didnt sell your permit again?
- 3 so just do the same
- 3 i didn't have one
- 9 sell your permit !!
- 15 i dont have one
- 3 oh well, just don't harvest
- 15 S3, u got a permit this time so sell it
- 9 yeap
- 3 okay
- 3 well we should all get over 200

# Instructions-RN08

## Baseline Treatment

### Sustainable Forest Management Experiment

University of Calgary – Department of Economics

#### General

In this experiment you take on the role of a **Forest Manager** responsible for a single parcel of forested land within a greater forested landscape. You are neighboured by other forest managers also responsible for a single parcel of forested land. Your responsibility as a forest manager is to maximize your individual profit. As a forest manager, you are capable of generating revenue in two ways: (1) from the harvest of timber on your land, and (2) from the trading of harvest permits allocated to you randomly by the governing authority. **A harvest permit is necessary to harvest the timber on your land.** There is no cost to harvesting and there are no transaction costs to trading.

**All participants begin the baseline experiment with no funds.**

**The experiment consists of 6 equal rounds of 5 stages each:**

**Stage 1 – Landscape Display (Passive; no action required)**

**Stage 2 – Allocation of Permits (Passive; no action required)**

**Stage 3 - Trading (Active; action required)**

**Stage 4 – Harvesting (Active; action required)**

**Stage 5 – Results (Passive; no action required)**



## Stage 1: Landscape Display

The greater landscape is a 3x6 grid of 18 individual, equally-sized parcels. You will be randomly assigned one of these individual parcels. Your forest grows over time, and will be either YOUNG or MATURE forest at any one time. YOUNG forest grows to become MATURE forest after one round of the experiment. MATURE forest does not grow further. If you harvest YOUNG or MATURE forest, it will grow to become YOUNG forest next round. **Every parcel of land within the greater landscape has a particular quality rating that affects the harvest value of MATURE forest on that land.** Land quality variation allows tree growth rates, forest density and timber volume to differ between parcels of land, resulting in different amounts of revenue from harvesting the trees on the land. Quality variation does not affect the harvest value of YOUNG forest.

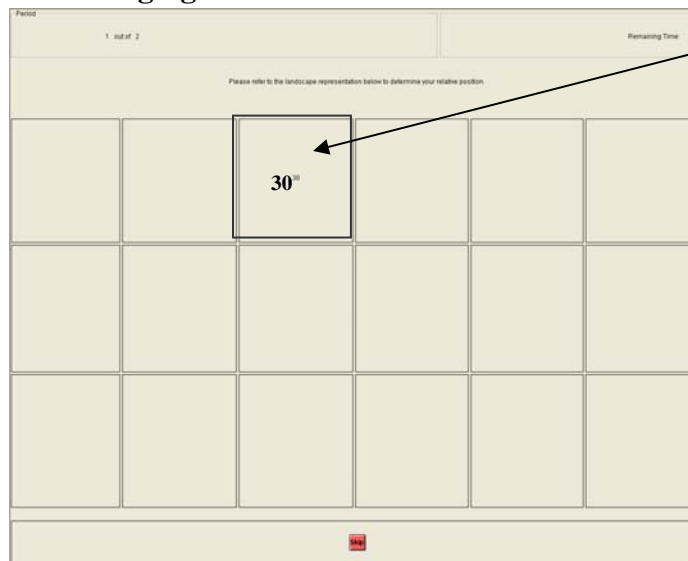
### For MATURE forest:

- 6 of the parcels in the landscape are **HIGH QUALITY** and have a harvest value of 35 Lab Dollars (\$L),
- 4 of the parcels are **AVERAGE QUALITY** and have a harvest value of 30 \$L,
- 8 of the parcels are **LOW QUALITY** and have a harvest value of 25 \$L.

**Young parcels have a harvest value of 10 \$L regardless of quality.**

**All parcels begin round 1 as MATURE. Keep this in mind for trading permits in Stage 3.**

You will be shown a representation of the landscape at the beginning of each round, displaying your individual harvest value at that time. **Note which parcel of land you are managing and what its current harvest value is. For example:**



## Stage 2. Allocation of Permits

The governing authority wishes to conserve old-growth forest and therefore harvesting of timber can only take place if you possess a harvest permit. **The governing authority will randomly allocate 6 tradable harvest permits at the beginning of each round of the experiment.** You may or may not receive a harvest permit from the allocation, but you must have a permit if you want to harvest the forest on your land.

If you didn't get allocated a permit but want to harvest, you will have an opportunity to buy one in the next stage. So, think about whether you can profit by buying a permit and harvesting.

If you were allocated a permit, you can save it so that you can harvest in the next stage, or you can sell it to someone else so that they can harvest. So, think about whether it is more profitable for you to sell your permit or to harvest the forest on your land.

**Note whether you received a permit to harvest the forest on your land.**

Period	1 out of 2	Remaining Time: 6
The governing authority has now randomly allocated 6 tradable permits to forest managers.		
You received a permit!		
<input type="button" value="Skip"/>		

### Stage 3. Trading of Permits

In this stage you can sell/buy tradable harvest permits. **Depending upon whether you received a permit in Stage 2, you will be categorized as either a “Seller” or a “Buyer”.**

**Tradable permits may only be bought or sold once, so trade wisely.**

#### Seller

You will be categorized as a “**Seller**” if you were allocated a permit in the allocation stage. If you are categorized as a **Seller** you can either keep your permit or **sell** it to someone who did not receive a permit in the allocation stage. If you sell your permit, you cannot buy another permit.

As a **seller**, you can make **Sell Offers**, or accept a **Buy Offer** by selecting a particular buying price (listed on your screen) and clicking the “**Sell**” button on your screen. A sell offer is a dollar value offer made by a seller to sell a tradable harvest permit, and may be selected by a buyer, thereby

completing a transaction. The sell offers of all sellers are listed for everyone to see, and a seller can only make a sell offer lower than the lowest standing sell offer. Your particular sell offers will be highlighted in blue text. A seller can only make a sell offer greater than, or equal to zero.

Period		Trading prices	
Sell offer	Period	Trading prices	Buy offer
1 out of 6 <span style="float: right;">Remaining Time: 55</span>			
Enter Your Sell Offer <input type="text"/>			
<b>Make offer</b>		<b>Sell</b>	
Land Harvest Value 30 Your Number of Permits 1 Available Funds 0			
<b>Skip Trading</b>			

## Buyer

You will be categorized as a “**Buyer**” if you were not allocated a permit in the allocation stage. If you are categorized as a **Buyer**, you can either forego harvesting, or you can **buy** one permit from someone who was allocated a permit. If you buy a permit, you cannot sell it to another forest manager. You cannot hold more than one permit at a time.

A **buyer**, can make **Buy Offers**, or accept a **Sell Offer** by selecting a particular selling price (listed on your screen) and clicking the “Buy” button on your screen. A buy offer is a dollar value offer made by a buyer to purchase a tradable harvest permit, and may be selected by a seller, thereby completing a transaction. Buy offers of all buyers are listed for everyone to see, and a buyer can only make a buy offer higher than the highest standing buy offer. Your particular buy offers will be highlighted in blue text. A buyer can only make a buy offer less than or equal to his/her current harvest value plus his/her available funds, so that no participant can go bankrupt.

Period		Remaining Time: 57	
Sell offer	Period	Trading prices	Buy offer
1 out of 6			
<input type="button" value="buy"/>			Enter Your Buy Offer <input type="text"/> <input type="button" value="Make offer"/>
		Land Harvest Value 30 Your Number of Permits 0 Available Funds 0	
<input type="button" value="Skip Trading"/>			

Once you have either purchased or sold a permit in the trading stage, you will immediately leave this stage and enter a waiting period until all other participants complete trading. If you do not wish to trade, you may simply skip trading and enter the waiting period. (Note: If you have already bought or sold, yet you do not leave the stage, simply select to skip trading to leave the stage, and your trade will still stand).

## Stage 4: Harvesting

If you have a permit at the end of the trading stage (if you were allocated one and did not sell it, or if you purchased one during trading) you will be given the option to harvest your timber, or forego harvesting. **If you do not harvest, you will receive no harvest revenue and your permit will go unused.** If you do not have a permit at the end of the trading stage, you will not be able to harvest your timber, and should select the “Don’t Harvest / I don’t Have a Permit” option in this stage.

If you harvest your timber, you will generate revenue equal to your current harvest value.

Once harvested, your forest is automatically replanted, and you will begin the next stage with YOUNG forest. If you do not harvest, your forest will grow to MATURE forest (if it was YOUNG) or will remain MATURE (if it was already MATURE).

Period 1 out of 1 Remaining Time 7

Please make your decision to harvest

Your Number of Permits 1  
Your current land value is 25

Harvest My Timber

Don't Harvest / I don't Have a Permit

### Note: Final Land Sale Value

In addition to the round-by-round decisions you must make, please also be aware that by the conclusion of the 6 rounds of the experiment, your forest parcel will still be worth something to future users. That is, **your land will have future value. This value will differ depending on how you leave your land.** If you leave your land with MATURE forest, it will be available for larger harvest value right away in the future; if you leave your land with YOUNG forest, it will only be available for larger harvest value after a period of growth. Given that economic agents discount future values in accordance with the time value of money, there will be a difference in the total present value of your land at the conclusion of the decision rounds. **If you leave your land mature at the end of the 6th round, you will receive a larger land sale value payment (approx. 40% higher).**

## Stage 5: Results

See what you made in this round. For example:

### Note: Payment

Each participant will receive two payments: (1) a show-up fee for participating in the experiment equal to \$5.00 and (2) a performance fee based on the **AVERAGE** profit you generated during the **THREE TREATMENTS** of the experiment equal to 1 Canadian dollar for every 7.5 units of currency in the experiment.  
 EXCHANGE RATE: 7.5 \$L = 1 \$CDN

Period									
1 out of 1	Remaining Time								
<table> <tr> <td>Harvest Revenue from this round</td> <td>0</td> </tr> <tr> <td>Trade Revenue from this round</td> <td>0</td> </tr> <tr> <td>Profit from this round</td> <td>0</td> </tr> <tr> <td>Total Earnings up to this round</td> <td>0</td> </tr> </table>		Harvest Revenue from this round	0	Trade Revenue from this round	0	Profit from this round	0	Total Earnings up to this round	0
Harvest Revenue from this round	0								
Trade Revenue from this round	0								
Profit from this round	0								
Total Earnings up to this round	0								

# Instructions – R3

## Ascending Auction Supplement

### Sustainable Forest Management Experiment

University of Calgary – Department of Economics

#### General

In this version of the experiment you will again take on the role of a Forest Manager who aims to maximize individual profit. This time there are three ways to gain profit: (1) through harvesting, (2) trading, and (3) selling a CONSERVATION CONTRACT to the governing authority (GA)

The additional feature in this treatment is that the GA wants to conserve mature forest parcels in a particular pattern on the landscape. It wants a mature forest corridor (a column of three mature parcels), and is willing to pay any group of three forest managers in a column to agree to a CONSERVATION CONTRACT, which commits them to retain mature forest on their parcels.

You will be placed in a group with the other two forest managers in your particular column. The way the GA decides which group will get the conservation contract, and how much they will get paid, is through an ascending auction in which groups will bid. In summary the characteristics of the auction are:

Auction Item: Conservation contract

Buyer: Governing Authority

Sellers: Groups of forest managers

**The GA selects lowest group bid for the conservation contract.**

**All participant begin this version of the experiment with 100 lab dollars (100 \$L)**  
**The experiment consists of 6 equal rounds of 9 stages each (new stages in bold type):**

Stage 1 – Landscape Display (Passive; no action required)

Stage 2 – Allocation of Permits (Passive; no action required)

**Stage 3 – Group Leader Selection (Active; action required)**

**Stage 4 – Group Communication (Active; action required)**

**Stage 5 – Contract Auction (Active; action required)**

**Stage 6 – Notification (Passive; no action required)**

Stage 7 - Trading (Active; action required)

Stage 8 – Harvesting (Active; action required)

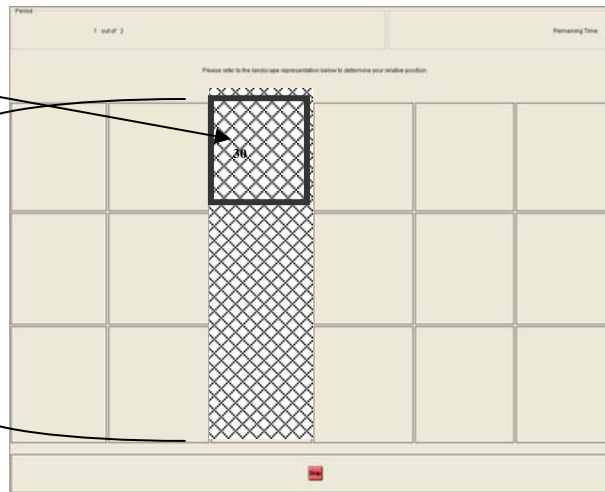
Stage 9 – Results (Passive; no action required)

## Stage 1: Landscape Display

Note which parcel of land you are managing and what its current harvest value is. For example:

Note whether you have MATURE forest, and could be part of a CONSERVATION CONTRACT for a MATURE FOREST CORRIDOR.

For example:



## Stage 2: Allocation of Permits

Note whether you received a permit to harvest.

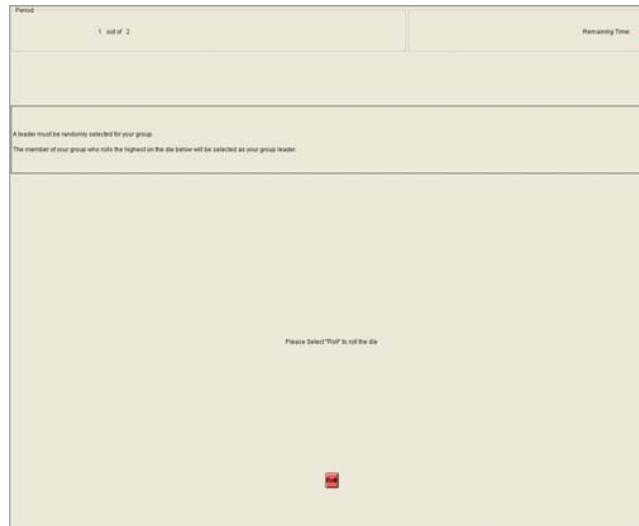




### Stage 3: Group Leader Selection

You have been assigned to a group with the two other forest managers in your column. Each group needs a leader to submit its bid for the conservation contract. To select the leader you must “roll the die” (electronically). The group leader will be the group member who rolled the highest number on the electronic die. **The group leader is in charge of placing the group’s bid in the contract auction stage.**

You and the other members of your group will roll in every period, so that a new leader can potentially be chosen each and every round. Each group member will be notified whether or not (s) he is the group leader.



## Stage 4: Group Communication

In this stage, you will find out who was chosen as group leader. In addition, information about you and your 2 other group members will be displayed on the screen.

The important aspect of this stage is that you and the other two members of your group can communicate with one another to establish whether or not your group would like to bid in the upcoming auction for the conservation contract, and if so, how much the group would like to bid.

You communicate by typing comments that will appear on the screen. **Make sure you are clear who the leader of your group is, and come to an agreement on whether or not you want to bid, and how much. The leader will be the one who carries out the bidding for the group.**

Period		Remaining Time: 65	
1 out of 2			
Your Number of Permits 0 Your Current Land Value 35 Total permits in your group 1 Total MATURE parcels in the group 2		Information about group member 1 or Subject 1 Age of their parcel Mature Quality of their parcel Low Quality Did they get a permit? No LEADER? No	
		Information about group member 2 or Subject 13 Age of their parcel Mature Quality of their parcel Low Quality Did they get a permit? Yes LEADER? Yes	

**On the next page is some important information to consider as your group decides about its bid.**

For example, assume a winning group bid of 100 \$L. There are two possible splits, shown below.

### Important information

After a group has been selected for the conservation contract, it is their responsibility to ensure that they do indeed conserve a corridor of old-growth (MATURE) forest. If the corridor is indeed conserved as MATURE forest at the conclusion of the round, the group shall receive the winning bid which will be distributed based on each subject's land quality. This is in addition to permit trading and harvest revenue.

Group Member	Member's Land Quality	Member's Share of Group Payment
1	High (35)	36 (36%)
2	Average (30)	32 (32%)
3	Average (30)	32 (32%)

Group Member	Member's Land Quality	Member's Share of Group Payment
1	High (35)	40 (40%)
2	Low (25)	30 (30%)
3	Low (25)	30 (30%)

However, it is very important to note that, **if the contract conditions are not met**, that is, if any one or all subjects do not conserve MATURE forest, then the contract will not be honoured and **the group will NOT receive the contract payment. In addition, ALL group members will pay a PENALTY for not honouring the contract, equal to 40 \$L split among group members based on their shares as listed above.**

## Stage 5: Contract Auction

**ONLY THOSE GROUPS WITH ELIGIBILITY (GROUPS WITH ALL MEMBERS CURRENTLY HOLDING MATURE FOREST) WILL ENTER THE CONTRACT AUCTION STAGE.**

In the **contract auction stage** group leaders will bid on behalf of their group for the conservation contract by pressing the “accept” button on the screen when the listed bid is at the price they wish to pay for the conservation contract.

The bid price will be listed in the centre of the screen and rise by increments of 5 units every 3 seconds until a bid is made or time expires.

Note that **the bid the leader is placing is the total group bid, not his individual bid price.** Please make the choice of a group bid clear in the communication stage.. Those group

members who are not their group leaders will remain in a waiting stage while the auction progresses.



## Stage 6: Notification of Auction Results

You are told whether or not your group has been selected for the conservation contract.

Period	Remaining Time
1 out of 2	7
<p>Your group has <b>WON</b> the contract!</p> <p>The winning bid was: 90</p> <p>Your portion of the group <b>PAYMENT</b>, if you honor the contract, is 30</p> <p>Your portion of the group <b>PENALTY</b>, if you do <b>NOT</b> honor the contract, is 12</p>	

## Stage 7: Permit Trading

Buy or sell permits, depending on whether you have a permit, your harvest value, and whether or not your group has a conservation contract. See stage 4 for penalties if you harvest when you are part of the group that was selected for the conservation contract.

## Stage 8: Harvesting

Harvest, if you have a permit. Again, see stage 4 for penalties if you harvest when you are part of the group that was selected for the conservation contract.

## Stage 9: Results

See what you made in this round. Recall, your total payment for the experiment (consisting of three treatments) is based on the **AVERAGE** of your profit from the three treatments.

Period													
2 out of 2	Remaining Time: 0												
<table> <tr> <td>Harvest Revenue from this round</td> <td>0</td> </tr> <tr> <td>Trade Revenue from this round</td> <td>0</td> </tr> <tr> <td>Portion of Group Payment from this Round</td> <td>0</td> </tr> <tr> <td>Portion of Group Penalty from this Round</td> <td>0</td> </tr> <tr> <td>Profit from this round</td> <td>0</td> </tr> <tr> <td>Total Earnings up to this round</td> <td>125</td> </tr> </table>		Harvest Revenue from this round	0	Trade Revenue from this round	0	Portion of Group Payment from this Round	0	Portion of Group Penalty from this Round	0	Profit from this round	0	Total Earnings up to this round	125
Harvest Revenue from this round	0												
Trade Revenue from this round	0												
Portion of Group Payment from this Round	0												
Portion of Group Penalty from this Round	0												
Profit from this round	0												
Total Earnings up to this round	125												

# Instructions – RN08

## Timed, Descending Auction Supplement

### Sustainable Forest Management Experiment

University of Calgary – Department of Economics

#### General

In this version of the experiment you will again take on the role of a Forest Manager who aims to maximize individual profit. This time there are three ways to gain profit: (1) through harvesting, (2) trading, and (3) selling a CONSERVATION CONTRACT to the governing authority (GA)

The additional feature in this treatment is that the GA wants to conserve mature forest parcels in a particular pattern on the landscape. It wants a mature forest corridor (a column of three mature parcels), and is willing to pay any group of three forest managers in a column to agree to a CONSERVATION CONTRACT, which commits them to retain mature forest on their parcels.

You will be placed in a group with the other two forest managers in your particular column. The way the GA decides which group will get the conservation contract, and how much they will get paid, is through a timed, descending auction in which eligible groups are included. In summary the characteristics of the auction are:

Auction Item: Conservation contract

Buyer: Governing Authority

Sellers: Groups of forest managers

**The GA has set up the auction as follows.**

- All eligible groups (those with mature forest) are automatically included as bidders in the auction.
- Starting with a high price, the price is automatically decreased in predefined steps.
- If a bidder accepts a new price, no action is required.
- If a bidder rejects the price, (s)he must **press the “quit” button** to exit the auction. **Bidding consists of pressing the “quit” button when the price has reached the level below which the group does not want the CONSERVATION CONTRACT.**
- The auction ends when the last bidder quits the auction.
- The last bidder to quit wins the auction and the winning bid is the price at which (s)he quit.

**All participants begin this version of the experiment with 100 lab dollars (100 \$L)**  
**The experiment consists of 6 equal rounds of 9 stages each (new stages in bold type):**

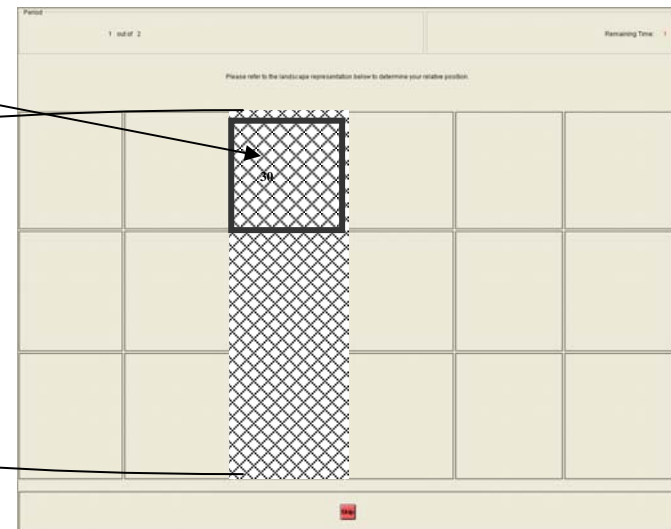
- Stage 1 – Landscape Display (Passive; no action required)
- Stage 2 – Allocation of Permits (Passive; no action required)
- Stage 3 – Group Leader Selection (Active; action required)**
- Stage 4 – Group Communication (Active; action required)**
- Stage 5 – Contract Auction (Active; action required)**
- Stage 6 – Notification (Passive; no action required)**
- Stage 7 - Trading (Active; action required)
- Stage 8 – Harvesting (Active; action required)
- Stage 9 – Results (Passive; no action required)

### Stage 1: Landscape Display

Note which parcel of land you are managing and what its current harvest value is. For example:

Note whether you have MATURE forest, and could be part of a CONSERVATION CONTRACT for a MATURE FOREST CORRIDOR.

For example.





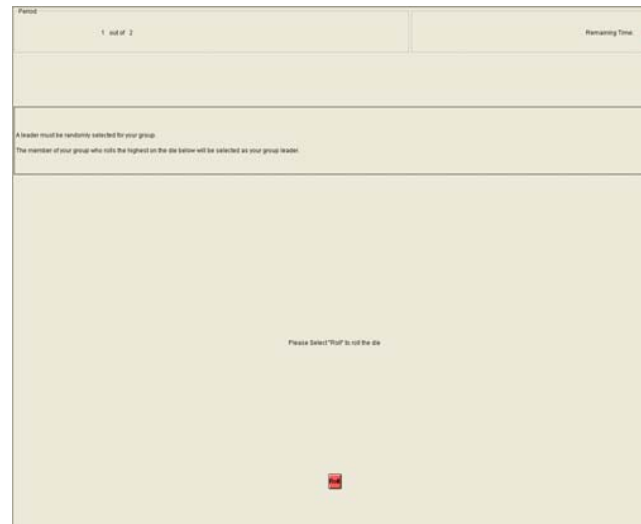
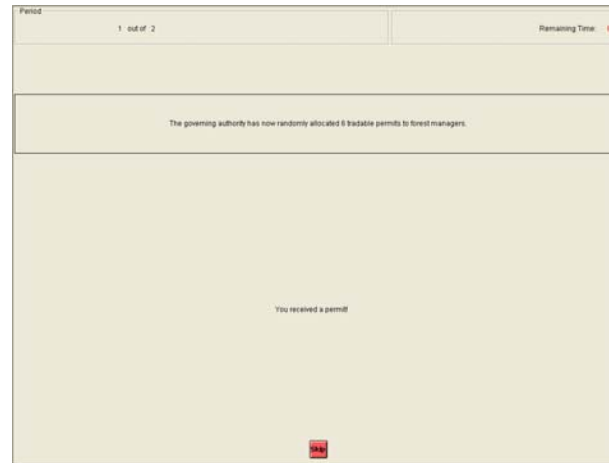
## Stage 2: Allocation of Permits

Note whether you received a permit to harvest.

## Stage 3: Group Leader Selection

You have been assigned to a group with the two other forest managers in your column. Each group needs a leader to be the bidder for the conservation contract. To select the leader you must “roll the die” (electronically). The group leader will be the group member who rolled the highest number on the electronic die. **The group leader is in charge of bidding for the group in the contract auction stage.**

You and the other members of your group will roll in every period, so that a new leader can potentially be chosen each and every round. Each group member will be notified whether or not (s) he is the group leader.



## Stage 4: Group Communication

In this stage, you will find out who was chosen as group leader. In addition, information about you and your 2 other group members will be displayed on the screen.

The important aspect of this stage is that you and the other two members of your group can communicate with one another to establish the price at which your group wants to quit the auction for the conservation contract.

You communicate by typing comments that will appear on the screen. **Make sure you are clear who the leader of your group is, and come to an agreement on the price at which you want to quit the auction. The leader will be the one who carries out the bidding for the group.**

Period		Remaining Time: 65	
1 out of 2			
Your Number of Permits: 0 Your Current Land Value: 35 Total permits in your group: 1 Total MATURE parcels in the group: 2		Information about group member 1 or Subject: 1 Age of their parcel: Mature Quality of their parcel: Low Quality Did they get a permit?: No LEADER?: No	
		Information about group member 2 or Subject: 13 Age of their parcel: Mature Quality of their parcel: Low Quality Did they get a permit?: Yes LEADER?: Yes	

**On the next page is some important information to consider as your group decides about the price at which it will quit the auction.**

For example, assume a winning group bid price of 100 \$L. There are two possible splits, shown below.

### Important information

After a group has been selected for the conservation contract, it is their responsibility to ensure that they do indeed conserve a corridor of old-growth (MATURE) forest. If the corridor is indeed conserved as MATURE forest at the conclusion of the round, the group shall receive the winning bid which will be distributed based on each subject's land quality. This is in addition to permit trading and harvest revenue.

Group Member	Member's Land Quality	Member's Share of Group Payment
1	High (35)	36 (36%)
2	Average (30)	32 (32%)
3	Average (30)	32 (32%)

Group Member	Member's Land Quality	Member's Share of Group Payment
1	High (35)	40 (40%)
2	Low (25)	30 (30%)
3	Low (25)	30 (30%)

However, it is very important to note that, **if the contract conditions are not met**, that is, if any one or all subjects do not conserve MATURE forest, then the contract will not be honoured and **the group will NOT receive the contract payment. In addition, ALL group members will pay a PENALTY for not honouring the contract, equal to 40 \$L split among group members based on their shares as listed above.**

## Stage 5: Contract Auction

**ONLY THOSE GROUPS WITH ELIGIBILITY (GROUPS WITH ALL MEMBERS CURRENTLY HOLDING MATURE FOREST) WILL ENTER THE CONTRACT AUCTION STAGE.**

In the **contract auction stage** group leaders will bid on behalf of their group for the conservation contract by pressing the “quit” button on the screen when the listed bid is at the price at which they wish to exit the auction.

The bid price will be listed in the centre of the screen and fall by increments of 5 units every 3 seconds until a bid is made or time expires after 42 seconds.

**Remember the winning bid is the price at which the last bidder quits the auction.**

Note also that **the winning bid is the amount that the group will receive, not the amount each individual in the**

**group will receive.** Please make sure the choice of the bid price at which your group will quit the auction is made clear in the communication stage. Those group members who are not their group leaders will remain in a waiting stage while the auction progresses.



## Stage 6: Notification of Auction Results

You are told whether or not your group has been won the conservation contract.

Period	Remaining Time
1 out of 2	7
<p>Your group has <b>WON</b> the contract!</p> <p>The winning bid was: 90</p> <p>Your portion of the group <b>PAYMENT</b>, if you honor the contract, is 30</p> <p>Your portion of the group <b>PENALTY</b>, if you do <b>NOT</b> honor the contract, is 13</p>	

## Stage 7: Permit Trading

Buy or sell permits, depending on whether you have a permit, your harvest value, and whether or not your group has a conservation contract. See stage 4 for penalties if you harvest when you are part of the group that was selected for the conservation contract.

## Stage 8: Harvesting

Harvest, if you have a permit. Again, see stage 4 for penalties if you harvest when you are part of the group that was selected for the conservation contract.

## Stage 9: Results

See what you made in this round. Recall, your total payment for the experiment (consisting of three treatments) is based on the **AVERAGE** of your profit from the three treatments.

Period													
2 out of 2	Remaining Time: 0												
<table> <tbody> <tr> <td>Harvest Revenue from this round</td> <td>0</td> </tr> <tr> <td>Trade Revenue from this round</td> <td>0</td> </tr> <tr> <td>Portion of Group Payment from this Round</td> <td>0</td> </tr> <tr> <td>Portion of Group Penalty from this Round</td> <td>0</td> </tr> <tr> <td>Profit from this round</td> <td>0</td> </tr> <tr> <td>Total Earnings up to this round</td> <td>125</td> </tr> </tbody> </table>		Harvest Revenue from this round	0	Trade Revenue from this round	0	Portion of Group Payment from this Round	0	Portion of Group Penalty from this Round	0	Profit from this round	0	Total Earnings up to this round	125
Harvest Revenue from this round	0												
Trade Revenue from this round	0												
Portion of Group Payment from this Round	0												
Portion of Group Penalty from this Round	0												
Profit from this round	0												
Total Earnings up to this round	125												

# Instructions – RN08

## Negotiation Supplement

### Sustainable Forest Management Experiment

University of Calgary – Department of Economics

#### General

In this version of the experiment you will again take on the role of a Forest Manager who aims to maximize individual profit. There are three ways to gain profit: (1) through harvesting, (2) trading, and (3) volunteering to provide a CONSERVATION CONTRACT to the governing authority (GA).

In this treatment groups will **no longer bid for the CONSERVATION CONTRACT, but volunteer for it in return for a fixed payment of 100 lab dollars (\$L), and will negotiate the distribution of the 100 \$L payment.**

In the communication stage, group members must discuss whether the

group will volunteer for the conservation contract, and how the 100

\$L is to be divided among the 3 members of the group.

**The leader has the responsibility, at some time during the communication stage, to input the negotiated portions for each group member, including himself, and establish them as a finalized negotiated agreement.**

**All participants will begin this version of the experiment with 100 \$L.  
The experiment consists of 6 equal rounds of 10 stages (new stages in bold type):**

Stage 1 – Landscape Display (Passive; no action required)

Stage 2 – Allocation of Permits (Passive; no action required)

Stage 3 – Leader Selection (Active; action required)

Stage 4 – Communication (Active; action required) – **INCLUDES NEGOTIATION**

**Stage 5 - Notification of Payment Portions (Passive; no action required)**

**Stage 6 – Volunteer Stage (Active; action required)**

Stage 7 – Notification (Passive; no action required)

Stage 8 - Trading (Active; action required)

Stage 9 – Harvesting (Active; action required)

Stage 10 – Results (Passive; no action required)

### Stage 1: Landscape Display

Note which parcel of land you are managing and what its current harvest value is.

### Stage 2: Allocation of Permits

Note whether you received a permit to harvest.

### Stage 3: Group Leader Selection

You have been assigned to a group with the two other forest managers in your column. Each group needs a leader to act on behalf of the group to inform the GA of the agreed payment portion for each group member, and to volunteer for the conservation contract.

To select the leader you must “roll the die” (electronically). The group leader will be the group member who rolled the highest number on the electronic die.

You and the other members of your group will roll in every period, so that a new leader can potentially be chosen each and every round. Each group member will be notified whether or not (s) he is the group leader.



## Stage 4: Group Communication

In this stage, you will find out who was chosen as group leader. In addition, information about you and your 2 other group members will be displayed on the screen.

The important aspect of this stage is that you and the other two members of your group can communicate with one another to establish whether or not your group would like to volunteer for the conservation contract in return for the 100 \$L payment, and how the 100 \$L will be split among the group members.

You communicate by typing comments that will appear on the screen. **Make sure you are clear who the leader of your group is, and come to an agreement on whether or not you want to volunteer and how the payment will be split.**

Period		Remaining Time: 65																		
1 out of 2																				
<table> <tr> <td>Your Number of Permits</td> <td>0</td> </tr> <tr> <td>Your Current Land Value</td> <td>35</td> </tr> <tr> <td>Total permits in your group</td> <td>1</td> </tr> <tr> <td>Total MATURE parcels in the group</td> <td>2</td> </tr> </table>	Your Number of Permits	0	Your Current Land Value	35	Total permits in your group	1	Total MATURE parcels in the group	2		<table> <tr> <td>Information about group member 1 or Subject</td> <td>1</td> </tr> <tr> <td>Age of their parcel</td> <td>Mature</td> </tr> <tr> <td>Quality of their parcel</td> <td>Low Quality</td> </tr> <tr> <td>Did they get a permit?</td> <td>No</td> </tr> <tr> <td>LEADER?</td> <td>No</td> </tr> </table>	Information about group member 1 or Subject	1	Age of their parcel	Mature	Quality of their parcel	Low Quality	Did they get a permit?	No	LEADER?	No
Your Number of Permits	0																			
Your Current Land Value	35																			
Total permits in your group	1																			
Total MATURE parcels in the group	2																			
Information about group member 1 or Subject	1																			
Age of their parcel	Mature																			
Quality of their parcel	Low Quality																			
Did they get a permit?	No																			
LEADER?	No																			
		<table> <tr> <td>Information about group member 2 or Subject</td> <td>13</td> </tr> <tr> <td>Age of their parcel</td> <td>Mature</td> </tr> <tr> <td>Quality of their parcel</td> <td>Low Quality</td> </tr> <tr> <td>Did they get a permit?</td> <td>Yes</td> </tr> <tr> <td>LEADER?</td> <td>Yes</td> </tr> </table>	Information about group member 2 or Subject	13	Age of their parcel	Mature	Quality of their parcel	Low Quality	Did they get a permit?	Yes	LEADER?	Yes								
Information about group member 2 or Subject	13																			
Age of their parcel	Mature																			
Quality of their parcel	Low Quality																			
Did they get a permit?	Yes																			
LEADER?	Yes																			

**The leader has the responsibility, at some time during the communication stage, to input the negotiated portions for each group member, including himself, and establish them as a finalized negotiated agreement.**

Period		Remaining Time: 79	
1 out of 2			
Your Number of Permits: 0 Your Current Land Value: 30 Total permits in your group: 0 Total MATURE parcels in the group: 2		Information about group member 1 or Subject: 10 Age of their parcel: Mature Quality of their parcel: High Quality Did they get a permit?: No LEADER?: No	
Your proposed payment portion (%): <input type="text"/> Group Member 1's proposed payment portion (%): <input type="text"/> Group Member 2's proposed payment portion (%): <input type="text"/>			
<b>Establish payment portions</b>			
		Information about group member 2 or Subject: 16 Age of their parcel: Mature Quality of their parcel: Average Quality Did they get a permit?: No LEADER?: No	

**It is also important to note that:**

1. If no settlement can be reached within the allotted time of the communication stage (90 seconds), then the portions will assume the default values associated with the fixed portion treatment already completed (i.e. based on each manager's current harvest value).
2. The 100 \$L (split among group members based upon the negotiations that take place each round) is paid if and only if the group obtains and successfully honours the conservation contract by not harvesting any of its 3 forest parcels during the round.
3. **If a group obtains the contract, but one or more group members violate the conservation contract, by harvesting their land during the round, the group will be forced to pay a PENALTY of 40 \$L. The 40 \$L penalty will be split among group members according the split they negotiated for 100 \$L payment.**

## Stage 5: Notification of Payment Proportions

The proportion of the 100 \$L payment each member will receive is confirmed.

1 out of 2 Remaining Time: 2

Your PORTION of the group contract is (%) 29

## Stage 6: Volunteer Stage

**Group leaders** volunteer on behalf of their group for the conservation contract. One group will be randomly selected if more than one volunteers.

1 out of 2 Remaining Time: 12

Please choose whether or not you would like to volunteer for the Conservation Contract

Click "Volunteer" if you would like to volunteer your group for the Conservation Contract

Volunteer

Click "Don't" if you do not wish to volunteer for the Conservation Contract

Don't

## Stage 7: Notification

You are told whether or not your group has been selected for the conservation contract. If your group is selected, you are also told your share of the payment, and your share of the penalty if your group defaults on the contract

Period	Remaining Time				
1 out of 2	2				
<p>Your group has been selected for the contract!</p> <table> <tr> <td>Your portion of the Group PAYMENT, if you honor the contract is</td> <td>32</td> </tr> <tr> <td>Your portion of the Group PENALTY, if you do NOT honor the contract is</td> <td>13</td> </tr> </table>		Your portion of the Group PAYMENT, if you honor the contract is	32	Your portion of the Group PENALTY, if you do NOT honor the contract is	13
Your portion of the Group PAYMENT, if you honor the contract is	32				
Your portion of the Group PENALTY, if you do NOT honor the contract is	13				

## Stage 8: Permit Trading

Buy or sell permits, depending on whether you have a permit, your harvest value and whether or not your group has a conservation contract. See stage 4 for penalties if you harvest when you are part of the group that was selected for the conservation contract.

## Stage 9: Harvesting

Harvest, if you have a permit. Again, see stage 4 for penalties if you harvest when you are part of the group that was selected for the conservation contract.

## Stage 10: Results

See what you made in this round. Recall, your total payment for the experiment (consisting of three treatments) is based on the **AVERAGE** of your profit from the three treatments.

Period													
2 out of 2	Remaining Time: 0												
<table> <tbody> <tr> <td>Harvest Revenue from this round</td> <td>0</td> </tr> <tr> <td>Trade Revenue from this round</td> <td>0</td> </tr> <tr> <td>Portion of Group Payment from this Round</td> <td>0</td> </tr> <tr> <td>Portion of Group Penalty from this Round</td> <td>0</td> </tr> <tr> <td>Profit from this round</td> <td>0</td> </tr> <tr> <td>Total Earnings up to this round</td> <td>125</td> </tr> </tbody> </table>		Harvest Revenue from this round	0	Trade Revenue from this round	0	Portion of Group Payment from this Round	0	Portion of Group Penalty from this Round	0	Profit from this round	0	Total Earnings up to this round	125
Harvest Revenue from this round	0												
Trade Revenue from this round	0												
Portion of Group Payment from this Round	0												
Portion of Group Penalty from this Round	0												
Profit from this round	0												
Total Earnings up to this round	125												