ECP 3302: INTRODUCTION TO ENVIRONMENTAL ECONOMICS
HOMEWORK 1

Write down your name and panther id and submit your answers in the Blackboard Drop Box as a word document by the due date.

Application 1: Open Access and Logging (application 3. 1 in your textbook)
The following data refers to the number of logging operations working in a stretch of tropical rainforest. Excluding externalities, the private cost of a logging operation is $25 thousand per week and logs sell for $1 a piece.

Fill in the chart below.

# of operations	Total Harvest (1000 logs)	Average Harvest (1000 logs)	Marginal Harvest (1000 logs)
0	0	-	-
1	40		
2	75		
3	105		
4	130		
5	150		
6	165		
7	175		
8	180		
9	182		

Now answer the following questions

1. What is the number of logging operations in the forest that maximizes total profits in the industry (ignoring externalities)? How much <u>total</u> resource rent is generated at this level of harvest? (hint: maximum profit occurs where marginal private cost equals marginal private benefit; rent is the difference between total revenue/benefit and total cost).

2. With open access to the forest, how many operations will wind up logging? With open access, will there be *any* resource rent earned by the loggers? (hint: under open access loggers consider the average revenue/benefit).

3. Suppose the externalities (e.g. loss of genetic material for medical/agricultural applications; release of carbon-dioxide stored in the "carbon sink" of the forest) associated with deforestation could be valued at $10,000 per operation. What is the efficient number of operators? What is the open access number of operators? (hint: with externality efficient number of operations occurs where marginal social cost (i.e., previous MC+ 10K) equals marginal benefit; social aspect of externality is ignored under open access).

4. Suppose access to the forest is controlled by a (perfectly enforced) fee system. What (weekly) fee would have to be charged to insure an efficient harvest level? (hint: consider the value of externality per operation in setting up the fee).

Application 2: Demand Curves for Public Goods (application 3.3 in your textbook)
Adam and Eve live on two sides of the Garden of Eden, a small suburban development. After they move in, an old PCB dump is discovered in between their houses. If X total tons of PCB's are removed from the dump, the two have a true willingness to pay (WTP) to finance a clean-up equal to: ADAM's WTP = 10 – X and EVE's WTP = 6 - X

a. Adam's WTP is higher than Eve's. Does this necessarily imply that Eve is less concerned about exposure to PCB's than Adam? Why or why not?

b. Draw one diagram illustrating the two individual's demand curves for clean-up, and the total demand for clean-up in the neighborhood (see demand for public good in figure 3.5 in your textbook, p. 41). What is the total WTP for 3 tons of clean-up?

c. If cleaning up 2 tons were to cost $12, is their sufficient WTP in this small community to finance it? What are two potential reasons why a voluntary clean-up might nevertheless fail?

Application 3: The Stray Cow Problem
Rancher Roy has his ranch next to the farm of farmer Fern. Cattle tend to roam and sometimes they stray onto Fern's land and damage her crops. Roy can choose the size of his herd. His revenues are $6 for each cow he raises. The schedules of his marginal cost of production (MCP) and the damage each additional cow creates (marginal cow damage or MCD) are given below.

# of Cattle	MCP	MCD
1	$3	$1
2	3	2
3	4	3
4	5	4
5	6	5
6	7	6

Farmer Fern can choose either to farm or not to farm. Her cost of production is $10, and her revenue is $12 when there are no cattle roaming loose. For each additional cow her revenue is reduced by the amount in the MCD column above.

To answer the following questions, you need to figure out four things: the profit maximizing number of cows for Roy to own, his profits, whether or not Fern will farm and what her profits will be. Remember that efficient outcomes maximize the net monetary benefits to both parties; in other words, total ranching plus farming profits.

1. What will be the outcome if there is no liability (Roy does not pay for any damages caused)?

2. What will be the outcome if Roy is liable for damages?

3. What is the efficient outcome (the outcome that maximizes total profits)?

4. Suppose that it is possible to build a fence to enclose the ranch for a cost of $9. Is building the fence efficient?
5. Suppose the farmer can build a fence around her crops for a cost of $1. Is building this fence efficient?

Application 4: Efficiency, Equity and Sustainability (application 6.0 in your textbook)
Suppose Pandora is deciding how to dispose of some hazardous waste. She can contain it safely, at a cost of $175, or bury it in the local landfill. If she chooses the second option, in ten years' time the stuff will have seeped out enough to permanently ruin the vineyard of Bacchus, who lives next door to the landfill. The vineyard has a value to him in ten years of $450 (*i.e.*, he'd sell it then for $450.) This is the only damage the hazardous waste will ever do. Assume there is no inflation.

1. What is the Present Value of $450 in ten years at a discount rate of 10%?

2. In the absence of regulation, Pandora is likely to bury the stuff and save $175. If the interest rate is 10%, is it *efficient* for Pandora to bury her waste in the landfill? Discuss how Bacchus could maximize his utility if he had the legal right to prevent the dumping. What does this say about the relative size of the total net monetary benefits under the two alternatives? How do total net benefits relate to efficiency?

3. Is burying the waste equitable? Why or why not? Could the use of an environmental bond satisfy a fairness problem if it exists?

4. Is burying the waste sustainable from a neoclassical point of view? From and ecological point of view? Why or why not?

Application 5: Travel-Cost Analysis (application 8.0 in your textbook)
The Forest Service would like to know whether they should set aside some National Forest land, previously slated to be logged, for hiking. You are helping do a travel-cost analysis to estimate the benefits of the set-aside. Survey data has been gathered from 500 hikers who visited a forest in a neighboring state. Using a statistical technique called regression analysis, you have controlled for differences in income, employment status, age and other important factors that might affect the number of hiking trips taken. Taking these factors into account, you have developed the following relationship:

Cost to get to Hiking Areas	# of Hiking Trips Per Person Per Year
$20	8
$40	6
$80	2

1. Graph the demand curve for hiking trips as a function of the "price" -- the travel cost.

2. Based on demographic information about the people living in the vicinity of the proposed park, you have estimated that 50,000 people will take an average of 4 hiking trips per year. For the average person, calculate: (1) the consumer surplus for a single visit to the new park by a visitor with travel costs of $20; (2) the total consumer surplus for an average visitor (hint: the area of a

triangle is 1/2(base*height); and (3) the total expected consumer surplus per year from the proposed park.