Econ 496/598, Natural Resource Economics

Winter 2012

Assignment 4

The due date for this assignment is Wednesday April 11 (at my office, H-1155-61). Assignments must be stapled and clearly written. Late assignments will be penalized (the longer the delay, the larger the penalty). No assignment will be accepted after April 13. This assignment has two parts. Part 1 has 5 questions and you have to pick 3 (though, I strongly suggest you work with all of them even if you submit only 3). Part 2 has two analytical-numerical problems and you have to answer both.

Part 1: Choose three out of five questions below. Each question worth 30 marks.

1. **OIL:** One of the most important characteristics of the oil industry is the high degree of concentration: market power on the supply side is evident as the existence of a strong international cartel shows (i.e., OPEC). The role of an oil cartel is to secure the highest possible profits for its members by reducing the competition (i.e., restricting the supply). The overall results are lower rates of oil extraction and higher appropriation of the scarcity rent on the behalf of the cartel members compared to the efficient allocation.

(a) What is the role of the price elasticity of oil demand? Fully explain your arguments.

(b) What are the three other factors (except the price elasticity of oil demand) that affect the "strength" of the cartel? Briefly describe each one of them.

(c) Can anyone argue that the existence of an oil cartel is (potentially) socially beneficial? Fully support your answer with proper arguments.

2. **FORESTS:** Forests are probably the most complex natural resource as they provide a variety of products and services (ranging from timber and water filtering, to recreation facilities and biodiversity).

(a) Analyze the effect of agricultural subsidies and of the property right system in Brazil on the deforestation of the Amazonian forest.

(b) What is the effect of poverty and national debt on the exploitation of forests? What does the empirical evidence show?

(c) Briefly discuss two forms of public policy aiming at ensuring the sustainability of forests.

3. **RECYCLING:** Recycling is a very common practice aiming to extend the economic life of the stock of a depletable resource.

(a) Analyze the importance of extraction and disposal costs on the recycling decision.

(b) What are the factors that affect the cost of recycling?

(c) Some studies relate the income of a household to the weight of the household's recycling bin. Can we conclude that recycling is a luxury good (i.e., the demand for recycling has income elasticity more than one, meaning that rich people recycle proportionally more compared to poor people)? Fully explain your answer.

4. **WATER:** The Canadian system of allocating water evolved after the systems adopted in different periods in the United States. The main target of a water allocating system is to ensure the efficient use and sustainability of this extremely valuable resource.

(a) Describe the "Prior Allocation" system adopted in Canada and explain its main difference to the "Prior Appropriation" system adopted in the States. Which system is more efficient? Why?

(b) Discuss the four alternative water charge rate structures in terms of their efficiency and applicability.

(c) Suggest three remedies for the inefficient allocation of water. Fully describe one of them.

5. **LAND:** The most typical characteristic of land as a resource is that it is locationally fixed. Therefore, alternative land uses are in general incompatible.

(a) Discuss the two main reasons for converting land to residential use.

(b) Briefly discuss the main reasons for converting land to agricultural use.

(c) What are the effects of the tax system on land conversion?

Part 2: Answer both numerical-analytical problems below. Each problem worth 30 marks.

Problem 1. The *rent-bid functions* for residential development, agricultural use, and wildlife are given by $NMB_R = 100 - d$, $NMB_A = 75 - 0.5d$, and $NMB_W = 50 - 0.25d$, correspondingly (where NMB denotes the net marginal benefit form the specific land use and d denotes the distance in kilometers from the city center).

(a) How many kilometers from the city center one has to cover for the land use to switch from residential development to farming? What is the distance from the city center one has to cover in order to first encounter a forest? Graph your results.

(b) Due to population growth the net marginal benefit for residential development increases by 10 units at every distance level. At the same time lower taxes on farming increase the net marginal benefit from agriculture by 15 at every distance level. Find the new rent-bid functions for residential development and agricultural use and answer the same questions as in part (a).

(c) How will your answers in parts (a) and (b) change if this is a circular island with radius of 120 kilometers?

Problem 2. *This question requires the use of some computational software; Excel with the Solver add-in works fine. You need to submit an e-file with your coding and you also must present the maximization problem in your hard copy and provide your numerical answers.* You are the owner of a parcel of land and you are considering of planting trees to produce timber. For the moment being this looks like a good investment since the wood price is high ($1 per cubic meter) and the discount rate is relatively low ($r = 5\%$). You have to choose between to species, spruce and fir. The former increases in volume (measured in cubic meter) according to $v_S = 200t$ while the latter grows according to $v_F = 210t - 0.2t^2$, where t is the age of the tree. Although the harvesting cost is the same for both species ($0.30 per cubic meter) planting spruce costs $200 while planting fir costs $223.

(a) Assuming that you can only plant one species at a time and you are not planning to replant any trees, what is the efficient harvesting age for each one of the two species? Which species will you choose (if any)?

(b) Repeat part (a) if there are two rotations of the same species every time (that is, either spuce-spruce, or fir-fir).

(c) Will you answers in part (b) change if you have an additional constraint that you want to retire in 25 years (i.e., all you investment must be cashed out in 25 years).