

# EC314-Fall 2010 Problem Set 5

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When you write up your answers, your goal should be to (1) be correct, and (2) convince your reader that your answer is correct. Answers which do not achieve these goals will not be awarded full credit. To accomplish the second objective, it is helpful if your work is legible and if all steps are presented, possibly with a line of explanation. **Please STAPLE pages together so that we do not lose them.** (This problem set updated: 18 August 2010).

## Problems

1. 10 units of water are to be allocated between urban and rural dwellers. Demand for the two groups is,

$$\begin{aligned}P_u(w_u) &= 10 - w_u \\ P_r(w_r) &= 5 - w_r/2.\end{aligned}$$

- (a) Find the allocation of water that maximizes social surplus. Illustrate this on a graph.
- (b) Suppose that rural dwellers own water rights and sell them in a competitive market market.
- Find the equilibrium allocation and price both analytically and graphically.
  - If the discount rate is  $\delta$  how much would the urban dwellers need to pay the rural dwellers to buy the water rights outright?
- (c) Suppose the rural dwellers are upstream from the urban dwellers and have the right to take as much water as they want, but cannot sell excess water.
- What is the resulting allocation of water?
  - What is the loss of consumer's surplus relative to the private property regime.
  - Do urban dwellers prefer the property rights regime of part b or part c? Explain.
2. (Problem 1 p134) Suppose that the growth equation for a stock of fish is

$$F(X) = aX - bX^2$$

- (a) Verify that this is a logistic growth equation. That is, show that it can be written in the form

$$F(X) = rX(1 - X/k)$$

where  $r$  and  $k$  are functions of  $a$  and  $b$ .

- (b) What is the MSY biomass?
- (c) What is the biological equilibrium of the fishery when there is no harvesting?
- (d) Suppose that harvesting of the species is always equal to  $H$  where  $H$  is less than the MSY for the fishery.
- Find the steady state equilibrium if the initial stock is greater than the MSY value. Explain *briefly* the dynamics of convergence to this equilibrium. Use a graph in your answer.
  - Find the steady state equilibrium if the initial stock is less than the MSY value. Explain *briefly* the dynamics of convergence to this equilibrium. Use a graph on your answer.