

**AAE / ECON / FOREST 531 (Natural Resource Economics)**

**Homework #3**

**Due in Class on Thursday, October 16, 2008**

1. Suppose a fishery is managed in steady state with an Individual Transferable Quota (ITQ) system.
  - a. What is the relationship between the equilibrium quota price and the optimal shadow price of the stock? Explain.
  - b. Graphically illustrate the effect of the following factors on the equilibrium quota price: i) a decrease in the government-set total allowable catch (TAC), and ii) an increase in fuel prices for the boats in the fleet. Explain.
  - c. Using the biological and economic functional forms used in class on 9/23 and 9/30, how should the fishery manager adjust the steady-state stock size in response to an increase in the discount rate if their objective is to maximize fishery profits? Explain.
  
2. You manage a forest products company with land recently planted ( $t=0$ ) with maple. The merchantable volume of timber at  $t \geq 0$  is given by  $Q(t)=at+bt^2-ct^3$ , where  $a=10$ ,  $b=5$ , and  $c=0.02$ .
  - a. What is the maximum volume and when does it occur?
  - b. What rotation length maximizes mean annual increment  $[Q(T)/T]$ , and what is the associated volume?
  - c. Suppose the net price per unit volume is  $p=1$  and the discount rate is  $\delta=0.05$ , what is the optimal single rotation  $T_S$ ; volume at harvest; and present value at  $t=0$ ? (Hint: use Solver) What is the marginal cost of waiting at  $T_S$ ?
  - d. If the cost of replanting is  $c=150$ , what is the optimal Faustmann rotation  $T^*$ ; volume at harvest; and present value at  $t=0$ ? (Hint: use Solver) What is the marginal cost of waiting at  $T^*$ ?
  - e. If the price increases to  $p=2$ , what are the new values for  $T_S$  and  $T^*$ ? (Hint: use Solver) Interpret the change from when  $P=1$ .
  - f. If the discount rate increases from  $\delta=0.05$  to  $\delta=0.1$ , what are the new values for  $T_S$  and  $T^*$ ? (Hint: use Solver) Interpret the change from when  $\delta=0.05$ .
  
3. E4.3 in Conrad (page 76). Hint: For parts (d) and (e), set up the equation  $G(T)$  that you derived in part (c) in Excel with an initial guess of  $T=150$ . Use Solver to pick a value of  $T$  to drive this equation to zero (in the Solver box, choose "Value of: 0" rather than "Max" under the "Equal to:" box).
  
4. E7.1 in Conrad (page 164).
  
5. Wisconsin's Managed Forest Law aims to "encourage sustainable forestry on private lands by providing property tax incentives to landowners" and is described more fully at: <http://dnr.wi.gov/forestry/ftax/MFL.htm>. Drawing on concepts discussed in class and in section 4.5 in Conrad, intuitively discuss the potential impacts of the Managed Forest Law on total long-run timber supply generated from Wisconsin. State your assumptions explicitly.