

AAE / ECON / Forest 531 (Natural Resource Economics)

Midterm Exam. Monday, October 29, 2007.

Name: _____

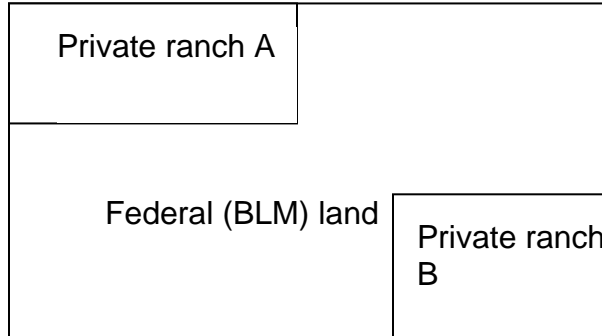
Please answer the following five questions, worth a total of 30 points. Question 1 is worth 10 points; questions 2 through 5 are worth 5 points each. Good luck.

1. **Mathematics / Derivation (10 points):** Consider the optimal management of a renewable resource where the net benefits of using the resource in time t are defined as $\pi_t = 0.5X_t^2 + 10Y_t$, and the resource has a natural rate of growth described by $F(X_t) = X_t - 0.5X_t^2$. Assume a discount rate of $\delta=0.05$. Solve for the maximum sustained yield ($X^{\text{MSY}}, Y^{\text{MSY}}$) and the bio-economic steady-state (X^*, Y^*). Recall that the bio-economic steady-state is the set (X^*, Y^*) that maximizes the present value of the net benefits from using the resource. Compare the two outcomes and provide intuition.

Short Answer Section (2-5 sentences; 5 points each)

Questions 2 and 3 are related.

Some background information regarding livestock grazing permits on government-owned land in the western United States. Livestock grazing permits on federal land managed by the Bureau of Land Management (BLM) allow the permit holder to graze cattle each year on BLM land. A typical situation is the one shown in the figure below, in which livestock owners have private ranchland for grazing, as well as permits for grazing on adjacent public land. Note that stocking a fixed land base with too much livestock can diminish the future productivity of the land.



2. Consider a management regime in which a permit **does not restrict the number of animals per acre**; rather, it grants the permit holder the right to use a certain block of federal land for grazing for **one year**. Permits are auctioned by the BLM at the start of each year. So, for instance, with reference to the figure above we might expect that each year various ranches, including ranches A and B, bid for grazing rights on the BLM land shown in the figure, with one ranch winning the right to graze the BLM land for the year. Permits are not transferable. Under this management regime, would you expect more or less livestock on the private ranch lands than on the BLM land? Explain your answer.

3. Now suppose that permits are **permanent and transferable, rather than annual**. In other words, permits are auctioned once, and the buyer has the right to graze the land permanently or transfer the permit to another rancher. Compare the number of livestock on BLM land in this situation to that on private land, and to that for your answer in 2. Explain.

4. Suppose you manage a wine cellar with fixed storage space and have to choose when to sell each bottle of wine. The value of each bottle $V(t)$ is increasing over time at a decreasing rate: $V'(t) > 0$ and $V''(t) < 0$. Once you open a bottle you free up storage space for a fresh bottle with value $V(0)$. The optimal time to sell each bottle is defined by what necessary condition? Explain your answer.

Note: Question #5 on back.

5. Consider the decision to harvest an old-growth forest when the future amenity values of the standing forest are uncertain. Under what conditions would harvest be *ex-ante* efficient and *ex-post* inefficient? Explain your answer.