

## **Resource & Environmental Economics Field Examination**

**January 2006**

### Instructions:

- You have 4 hours to complete the exam. This time commences at the end of the 15-minute reading period during which no writing is allowed.
- Please use your assigned "alpha letter" on every page to identify your exam and number each page. Do not use your name or social security number. Write on only one side of the page leaving at least one inch margins. Upon turning in the exam make sure the pages are in order.
- You have four questions to answer.

Answer four of following five questions.

1. Some of the earliest applications of transferable rights were in the area of what is known as *transferable development rights* (TDR). These programs seek to preserve open spaces in a community by limiting the total number of acres that can be developed and mandating that a number of acres must remain permanently undeveloped.
  - a. Give a theoretical explanation as to why government intervention in the use of land might be socially efficient.
  - b. Consider an alternative approach to land management: zoning, where certain areas are designated as developable and others are designated as protected. Show why a transferable development right program might be more efficient than zoning. Under what conditions might zoning be more socially efficient than the TDR
  - c. Assuming that a transferable development program is used, give a theoretically based prediction of how would you expect the price of a right to develop change over time. State the assumptions that you make.
  - d. Suppose that you were asked to design such a program. Briefly define each of the following concepts, and explain how would be applied in the TDR program: (i) asset unit, (ii) the initial allocation, (iii) the type of program – cap and trade vs. baseline and credit.
2. Coal is a nonrenewable resource. For this question, assume that coal reserves are known exactly and that the unit cost of extraction is constant (in real dollars). Demand for coal is downward sloping with a choke price of  $k$ .
  - a. Based on simple economic theory, how would you expect the price of coal and the quantity used per period to change over time? Explain.
  - b. Since coal is an emitter of  $\text{CO}_2$ , a greenhouse gas, it is likely that it will be taxed in the future. If a constant tax,  $t$ , is imposed on each ton of coal extracted, how would this change the price and quantity paths identified in the first part of this question?
  - c. Suppose that you are charged with identifying a socially optimal tax policy to control  $\text{CO}_2$  emissions from coal. Specify a parsimonious optimization model that you would use to frame your analysis and speculate or show how the tax might change over time.
3. Hurricanes have plagued the U.S. the last several years. Some argue that under climate change we will have more and stronger hurricanes in the future. Suppose someone wanted you to do an economic analysis of how a 10% increase in the number of hurricanes would affect the U.S. plus an increase in their intensity. You are charged with analyzing the agricultural and forestry sectors. Propose an approach you would use to estimate the net economic effects on these sectors of the change in hurricane frequency. Include an economic conceptual foundation for your approach and the methodology that you would suggest.

4. In North Texas there is an aquifer called the Ogallalla. This aquifer recharges very slowly and ground water pumping by cities and irrigators is causing the water table to drop, leaving people in the region concerned about their future economic well being.
  - a. Develop an economic rationale for why a shared aquifer might fall at a rate faster than the local populace desired.
  - b. A few years ago state policy makers subsidized water-conserving technology in the region, by offering no-interest loans for the purchase of new household fixtures (such as toilets and showerheads) and new irrigation systems. Policy makers found they spent a lot of money, but water use actually increased. What economic explanation can be forwarded for this result?
  - c. Suggest economically based policies that might arrest the rate of aquifer depletion, discussing their relative efficiency.
  
5. One of the issues involving climate change is damage to unmanaged ecosystems. There are unique areas of the U.S., like Yellowstone Park, the California redwoods, and the northeastern sugar maple zone, where climate change is expected to make the current mix of vegetation and species nonviable. These areas are important in several ways including the provision of major tourism destinations. How would you estimate the costs and benefits of loss of some of the services from one of these areas?