ECON4925 Environmental economics, Spring 2010

Lecture 1: Overview (Michael Hoel)

Issues in resource economics

I. Types of resources
   - Non-renewables
     - Minerals, oil, gas, coal
   - Renewables
     - Fish, forests, water
II. Questions to be studied
   - Optimal depletion of non-renewables
   - Optimal harvesting of renewable
   - Market forms
     - Perfect competition
     - Monopoly
   - Policy instruments to achieve optimality
   - Role of ownership for utilisation of common-pool renewable resources
   - Effect of trade and institutions on resource use
III. Main types of models
   - Cake - eating model
     - limited amount of non-renewable resources
     - Hotelling's rule
   - Limited non-renewable resources, production of man-made resources
   - Biological growth of renewable resources
     - Modelling the growth process
     - Role of steady state and sustainability
IV. Necessary mathematical skills
   - Differential equations
   - Optimal control theory

Resources discussed in the course

Resource	Is sustainable use possible?	Does use today affect availability tomorrow?
Fossil fuels	No	Yes
Minerals	No	Yes
Hydropower	Yes	Yes within a year
Wind and solar energy	Yes	No
Forests	Yes	Yes
Fish	yes	Yes

Non-renewable resources (fossil fuels and minerals):

$\max U(x_1 ... x_n)$ subject to $\sum_i x_i \leq S_0$ gives (if $\sum_i x_i = S_0$) $U_{x1} = ... = U_{xn}$

Special case of $U(x_1 ... x_n) = \sum_i \beta^{i-1} u(x_i)$ gives

$\beta^i u'(x_i) = u'(x_1)$. Obvious interpretation of β is $\beta = \dfrac{1}{1+r}$ where r is a discount rate

I.e. present value of marginal utility is the same in all periods. Or present value of resource price is the same in all periods.

Hydropower: Similar problem as above within each year

Wind and solar energy: Very low operating costs, so once installed used at full capacity (if electricity price is positive). Stochastic production.

Forests and fish: Renewable resources; sustained use is possible. Maximal sustainable yield is not economically optimal for r>0. Private ownership versus open access.

Discounting and sustainability: What is the economic background for r>0? What is optimal resource use in the context of optimal economic development?