**Natural resource economics: Syllabus things**

Course objectives:

* Learn how to use resources **over time** that maximizes their value
  + Over time is the main difference between this and previous econ class
* What are the EJ implications for how a given market works
* **Solve problems numerically using optimization algorithms in R**

Textbook:

* John Conrad *Resource Economics, Second Edition*

Readings:

* The readings are optional but highly encouraged

**Grading:**

Homework Assignments 40% of grade

* Five homework assignments
* May work on them in groups but turn in your own paper
* Assignments 1-4 are going to be R coding exercises
  + Available on Tuesday, introduction to the problem on Wednesday, and due the following week on Wednesday
* Assignment 5 is based on group presentations, we answer questions based on the presentations that other classes give

Take home Midterm 30% of grade

* R coding exercise done on our own
* Handed out before November 7, due at the beginning of class on November 13

Group presentation and final slide deck 30% of grade

* Identify an interesting dynamic natural resource problem, formulate a research question, develop a mathematical statement of the problem, find a numerical solution to the problem, and report on their findings
* Three deliverables
  + First part is 1 page description
  + Presentation to the class
  + Final slide deck

**NO FINAL EXAM!**

Economics is the study of how society allocates scarce resources

**Natural resource economics** is the study of how society allocates scarce natural resources over time

**Time (dynamics)**

* **Renewable resource** (any resource that grows)
  + Xt = stock in biomass **in** time t
  + Yt = harvest **in** time t
  + F(Xt) = growth in resource (notice that it is dependent on the stock)
    - If you have low or high fish you’re likely not experiencing a lot of growth
  + Xt+1 = Xt + F(Xt) – Yt
* **Nonrenewable Resource** (no growth or at least slow enough)
  + One type is what is called an exhaustible resource
  + Rt+1 = Rt – qt
  + Rt = Stock in time t
  + qt = harvest or consumption in time t
  + \* **notice there is no growth,** so it eventually will diminish to zero
    - **What’s important to note here is the concept of scarcity**
* **Stock pollutants** 
  + Zt+1 = Zt – gamma\*Zt + alpha\*qt
  + Zt = stock of pollutant in t
  + Alpha\*qt = flow of emissions in t (basically the quantity of the good, so the alpha term will serve to convert the units of qt to those of Zt)
  + Gamma\*Zt = decay of the pollutant in t (gamma is the rate, so multiplying it by Zt will convert it to a total decay in time t)
* **Optimal Allocation**
  + Xo = initial stock (state of resource)
  + Yt = control variable in t (we get to choose this) [control variable]
    - Y\*o, Y\*1, Y\*2 …. Y\*t
    - Allows us to determine the state of the resource in a given time (X\*1, X\*2, … X\*t)
  + Xt = stock (state of resource in time t) [state variable]
  + If you complete this optimally it will **satisfy some objective**, (this is the star/asterisk next to the Y variables and X variables
  + **Objective** is a very broad notion
    - Provides a way to think about the flows of resources that might not have to do with markets at all
* **Steady-state equilibrium (make sure to plot the upside down U graph in R)** 
  + Typically to do with renewable resources
  + EX: Renewable resource (e.g. a fishery)
  + Xt+1 = Xt + F(Xt) – Yt
  + F(Xt) = rXt(1- Xt/K)
  + Xt+1 = Xt + rXt(1- Xt/K)– alpha\*Xt (alpha acts as a constant fraction of the stock that is harvested)
    - 0 < alpha < 1
  + EX: suppose alpha = 0 ; now our stock evolves according to this relationship
  + Xt+1 = Xt + rXt(1- Xt/K)
  + X1 = Xo + F(Xo)
  + Xt+1 = Xt + F(K) 🡪 Resource is not growing anymore
  + K = K + 0
  + Xss = K (ss stands for steady state)
  + Xss = 0 (because stock doesn’t grow when it’s at zero)
  + EX: suppose alpha is positive
  + Alpha acts as the rate of harvest (extending from origin)
  + Alpha\*Xt = Yt

There is a tension between models that are too complicated versus too simple, so its important to make a model that is both applicable in terms of specificity but useful in that it isn’t too complex to be non-functional