# Environmental Risk Economics

Oct. 7

## Introduction

Instructor
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# Environmental Risks

- "Environmental risks" are:
  - uncertain consequences of environmental changes with known or unknown distribution of probabilities that these consequences happen
    - air/water/soil pollution
      - emissions of pollutants such as SOx, NOx, pesticide (農薬), phosphorus (リン), nitrogen (窒素), heavy metal (重金属), and organic solvents (有機溶剤)
    - climate change
      - $CO_2$ emissions
    - waste
      - garbage (non-hazardous waste) and hazardous wastes
    - loss of biodiversity
      - housing/agricultural/industrial land developments
    - natural disasters
      - earthquakes, volcanic eruptions, landslides, tsunamis, floods, droughts, heavy rains, typhoons, heavy snowfalls

# Complex Environmental Risks (1)

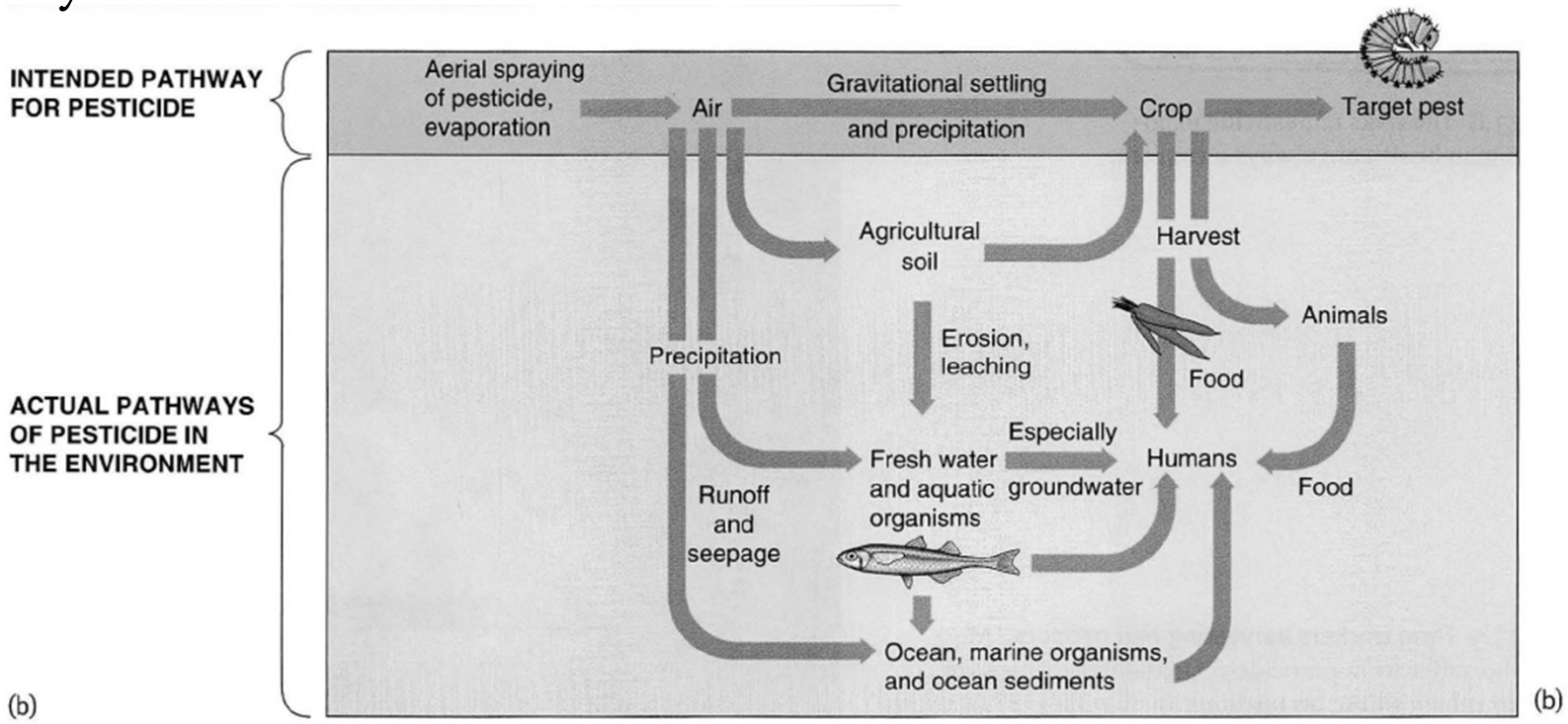
Pesticide residue (残留農薬):

- factors and results
  - economic activity: agriculture
  - consequences: pesticide residue in the soil, water, air, food, etc. and influences on ecosystem
  - damages: adverse reaction (薬害反応) and the environmental degradation
- randomness of
  - how farmers distribute pesticides in their agricultural lands,
  - the pathway of the contaminated water,
  - weather, and
  - rate of cancer from ingesting specific amounts of pesticides through drinking water (ex. age and other characteristics of the consumer)
- uncertainties of causal relationships:
  - between the economic activity and the consequences in the environment (natural sciences), and
  - between the consequences and the damages (life sciences and social sciences)

# Complex Environmental Risks (2)

The pathways of pesticides in our environment:

- the actual pathway of pesticides in the environment is quite different from the intended pathway
- if the pesticide level in the aquatic ecosystem is high enough, the fish may die




Source: Raven and Berg (2006) *Environment*, John Wiley & Sons, Inc., p. 539

# Complex Environmental Risks (3)

The pesticide mobility:

- Pesticides do not stay where they are applied but tend to travel into the soil, water, and air, sometimes long distances
  - in 1994, The study of the Environmental Working Group (EWG) in the U.S. reports that:
    - 14.1 million residents in Midwestern states drink water containing a small amount of 5 widely used herbicides (除草剤) which are often used on corn and soybeans; and that
    - 3.5 million people living in the Midwest face a slightly increased cancer risk because of their exposure (Raven and Berg, 2006)
- Environmental risks of pesticide usage
  - uncertain pesticide residue in the soil, water, air, food, etc. and uncertain influences on ecosystem

# The Goal of This Course

The goal of this course is:

- to acquire the point of view of economists
  - firms
  - consumers/households
  - a government
- so that you can consider issues related to environmental risks like an economist

Economics is:

- a *social science* which studies the social problem of *choice* from a scientific point of view
- build on a systematic exploration
  - formulation of theories and analysis of data

# Positive and Normative Economics

Positive (実証的) economics aims to:

- explain economic behavior:
  - why markets and institutions have evolved as they have
  - how they work (ex. restriction of output by OPEC and gasoline price)

Normative（規範的）economics aims to:

- design government policies to intervene in the market to improve social welfare:
  - how and to what extent government should intervene in the market (ex. electricity market and the risk of climate change)

# Lectures in the Course (1)

1. Fundamental Economic Theory:
   - consumers behaviors and demand for goods
   - firms behaviors and supply of goods
   - market mechanism and sources of price changes
   - the impact of a price change in another market
   - what are “short- and long-run” economists say
   - government intervention in the market
2. Social Choice and Welfare:
   - collective choice on a government policy or a public work
   - what is “efficient” economists say
   - social decision-making on an environmental policy
     - individual preferences and an social preference
     - Pareto criterion and social welfare functions

# A Dam on Baram River in Malaysia (1)

- Malaysia's largest state, Sarawak
  - aims to promote growth of aluminum smelters (精錬所), steelmakers, and other energy-intensive heavy industries (重工業) with the cheap hydroelectric power
- One of Sarawak's plans for economic development by 2030:
  - growth in economy by 5 times
  - increase in the population by 4.6 million

Rendering of Baram dam.
Source: Website of Sarawak Energy


Source: Website of International Rivers

Source: *National Geographic News*, Feb. 27, 2013

# A Dam on Baram River in Malaysia (2)

- Construction of dam will
  - submerge 412 square kilometers of rain forest in water, displacing some 20,000 indigenous people
- Endangered species:
  - Bornean bay cat, Borneo gibbon, Hose's civet, Rajah Brooke Birdwing (one of the world's largest butterflies)
- Indigenous people:
  - difficulty finding employment for indigenous people
  - the tribes of *Penan*, *Kenyah*, and *Kayan* have strongly opposed to the plan.
- Conflict of interest between people in the urban area and indigenous people

Photo: Bornean Bay Cat.
Source: Jim Sanderson, Mongbay.com

Photo: Borneo Gibbon
Source: Website of ARKive

Source: *National Geographic News*, Feb. 27, 2013

# Lectures in the Course (2)

3. Cost-Benefit Analysis:
   - applying the value judgment of "efficient"
   - the benefits and costs generated over a long time
     - time discounting
   - uncertainty
     - expected value analysis
4. Environmental Valuation:
   - how to measure the demand for the environment
     - no price and the market for exchanging the environment
   - four pathways of impacts of the environmental change
   - use value and nonuse value

# Oil Spill Disaster in Alaska, U.S. (1)

- Alaska's Prince William Sound, US, in March 1989
  - Exxon *Valdez* dashed against rocks and spilled 11 million gallons of oil into the shoreline
  - the massive death of wildlife, including salmon, 2,800 sea otters (ラッコ), 250,000 birds, and over 250 seals (アザラシ)
  - a majority of the species affected by the spill have not yet been fully recovered even in 2011

Photo taken in 1989 by Erik Hill, *Anchorage Daily News* (2010)

Photo taken in Jul. 1989 by Jim Lavrakas, *Anchorage Daily News* (2008)

Source: William Yardley, (March 3, 2011. The *New York Times*.; Kling et al. (2012, *J. Econ. Persp.*)

# Oil Spill Disaster in Alaska, U.S. (2)

- Exxon Corporation (the present Exxon Mobil Corp.)
  - more than $1 billion spent on correcting the environmental damage
  - more than $2 billion spent on trying to limit the extent of damage
- Environmental valuation
  - environmental valuation in 1992 by economists who were asked to study by the state of Alaska and the Federal Government
  - environmental damage of $2.8 billion is estimated
    - the value which is not accompanied by usage of the environment (nonuse value)

Photo by Bob Hallinen, Anchorage Daily News Archive 1989

Source: Stiglitz, J., (2000) *Economics of the Public Sector*, p.220-221); Carson et al. (1992)

# Lectures in the Course (3)

5. Market Failure:
   - public goods and externality
   - regulation

6. Property Rights:
   - property rights to emit pollution vs to enjoy a clean environment
   - government's granting property rights
   - Coarse theorem

7. Economic Incentive Mechanisms:
   - taxes or emission fees (ex. carbon taxes)
   - subsidies
   - tradable permits (ex. EU Emission Trading System, water quality trading)

# Schedule of Lectures

| Period | Date | Topic |
|---|---|---|
| Lesson 1 | October 7 | Introduction of the Course |
| Lesson 2 | October 14 | Fundamental Economic Theory |
| Lesson 3 | October 21 | |
| | October 28 | *No class* |
| Lesson 4 | November 4 | Social Choice and Welfare |
| Lesson 5 | November 11 | Cost-Benefit Analysis |
| Lesson 6 | November 18 | |
| Lesson 7 | December 2 | Environmental Valuation |
| Lesson 8 | December 9 | |
| Lesson 9 | December 16 | |
| Lesson 10 | January 6 | Market Failure |
| Lesson 11 | January 13 | Property Rights and Regulation |
| Lesson 12 | January 20 | |
| Lesson 13 | January 27 | Economic Incentive Mechanisms |

Note: The lecture schedule may slightly change due to the progress of lectures.

# Grading

## Assignments:

- we will give an assignment in the last lecture of each topic except the last topic.
- totally, 6 assignments will be given.
- each assignment will be evaluated on 10 point scale.
- you can download all assignments from the page of “Courses” in my website (http://www.ecn-ito.com/ or google “nobuyuki ito”)

| Requirement | Score |
|---|---|
| Assignments | 60 |
| Final Exam. | 40 |

## Password:

- Password to open files is: