

Lecture 7– Resources and the Environment

Sustainable Development

ECON 211 – 70: Economic Development

Chapter 10 Lecture - The Environment and Development

Sustainable Development

Development that meets the needs of the people today without compromising the ability of future generations to meet their own needs.



1

Why are Environment Issues Different From Other Economic Issues?

- Environmental questions are usually related to the issue of externalities:
 - Situations where the social cost (or benefit) is different from the private
 - In these cases, the market solution won't be efficient
- Environmental questions are usually related to resources which are renewable: they can generate themselves, given time, but they cannot be produced once they are extinguished

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Environment and Development: The Basic Issues

- Environmental issues affect, and are affected by, economic development
- Classic market failures lead to too much environmental degradation
- Poverty and lack of education may also lead to non-sustainable use of environmental resources
- Global warming and attendant climate change is a growing concern in developing countries
- Environmental problems have consequences both for health and productivity
 - Loss of agricultural productivity
 - Prevalence of unsanitary conditions created by lack of clean water and sanitation
 - Dependence on biomass fuels and pollution
 - Airborne pollutants

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The Poor as Both Agents and Victims of Environmental Degradation

- **Victims:**
 - The poor live in environmentally degraded lands which are less expensive because the rich avoid them
 - People living in poverty have less political clout to reduce pollution where they live
 - Living in less productive polluted lands gives the poor less opportunity to work their way out of poverty
- **Agents:**
 - The high fertility rate of people living in poverty
 - Short time horizon of the poor (by necessity)
 - Land tenure insecurity
 - Incentives for rainforest resettlement

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Environment and Development: Sustainability and Economic Analysis

- Sustainable development has been defined as “meeting the needs of present generation without compromising the wellbeing of future generations”
- To a large extent, sustainable development can be studied using longstanding concepts of economic analysis. These include the following three tools:
 - First: using an appropriate valuation of future social benefits - usually involving valuing the future at a significantly higher rate than does the market (details later chapter)
 - Second: Paying proper attention to market failures (focusing on externalities and public goods)
 - Third: Explicitly valuing natural resources as a form of capital stock rather than just a stream of consumption

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Environment and Development: Sustainability

- **Again:** Sustainable development has been defined as “meeting the needs of present generation without compromising the wellbeing of future generations”
- **Therefore:** running down the capital stock is not consistent with the idea of sustainability
- Environmental and other forms of capital are substitutes only to a degree; eventually they likely act as complements
- In developing countries, environmental capital is generally a larger fraction of total capital
- To know whether environmental capital is increasing or decreasing, we need environmental accounting

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Environment and Development: The Basic Issues

Sustainable net national income is:

$$NNI^* = GNI - D_m - D_n$$

Where

NNI^* is sustainable national income

GNI is Gross national income

D_m is the depreciation of manufactured capital

assets

D_n is the depreciation of environmental capital

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Environment and Development: Basic Issues (Continued)

Expansively, sustainable net national product is:

$$NNI^{**} = GNI - D_m - D_n - R - A$$

Where,

NNI^{**} is the revised (more disaggregated) NNI calculation

GNI is Gross national income

D_m is the depreciation of manufactured capital assets

D_n is the depreciation of environmental capital

R is expenditure needed to restore environmental capital

A is expenditure required to avert destruction of environmental capital

(Note: R and A are components of GNI but not NNI^{**})

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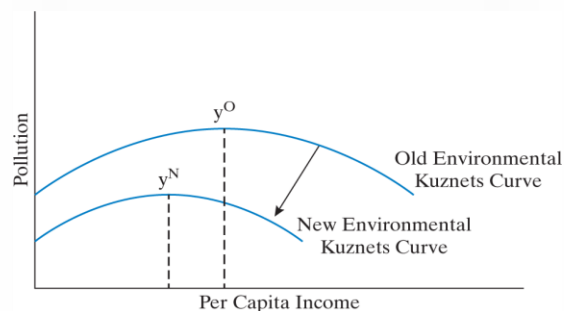
A Simple Numerical Illustration

- $NNI^{**} = GNI - D_m - D_n - R - A$
- **GNI = 100 billion rupees**
- **Depreciation = 20 billion rupees**
- **NNI = 80 billion rupees**
- **Natural resource degradation = 10 b rupees**
- **NNI* = 70 billion rupees**
- **Then unpacking R and A from NNI*:**
- **R = 5 billion rupees (restoring capital)**
- **A = 5 billion rupees (averting destruction)**
- **NNI** = 60 billion rupees**

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Hypothetical Income-Pollution Relationship: Environmental Kuznets Curves



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The Environmental Kuznets Curve: Variations

- **Inverted-U observed for such items as***
 - Lead
 - Sulfur dioxide,
 - Particulate matter in the air
 - Nitrogen oxide
- **Decreasing pollution observed throughout e.g. in:**
 - Water quality
 - Basic sanitation
- **And increasing pollution observed throughout –so far and in most cases – in other important items including:**
 - Greenhouse gases
 - Biodiversity
 - Landfill volumes

NOTE: Even if environmental Kuznets curve relationships do hold in the long term, for some items such as loss of biodiversity damage may be irreversible

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Environmental Kuznets Curve: An Aside

- **Explanations:**
 - Institutional Reform (e.g. democratic responsiveness)
 - Public Goods Provision
 - Private Sector Action
 - Scope of Voluntary Action (including NGOs)
 - Locus of curves depends on factors such as institutional quality and its evolution over time
 - Local/regional vs national/global

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Natural Resource Based Livelihoods: Pathways Out of Poverty?

- In low-income countries, high dependence on natural resources: agriculture; animal husbandry, fishing, forestry, hunting, foraging
- But access to the benefits of resources often very inequitable
- Poor losing control of natural resource commons areas
- Many poor lack farmland, forests, cattle, boats and equipment
- Common village lands may be “spontaneously” privatized
- Governments may overlook companies logging, fishing, and mining, without regard to local people or traditional rights
- Governments designate lands “protected,” banning livelihoods, while corruption remains; no incentive to take part in protection
- An important part of the solution: “pro-poor governance” – empowerment of the poor

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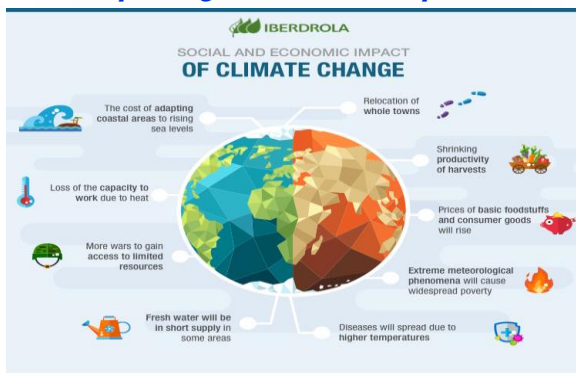
Global Warming and Climate Change: Scope, Mitigation, and Adaptation

- The Fourth (2007) and Fifth (2014) Benchmark IPCC Assessment Reports painted a dire picture for developing economies
- Recent follow up reports have amplified findings and concerns:
 - Summary in World Bank 2009 World Development Report
 - 2010 U.S. NOAA study found evidence of global warming due to greenhouse gases on all 11 indicators examined
 - 2012 and 2013 “Turn Down the Heat” Reports show severity of consequences for developing countries
 - 2013/2014 Fifth IPCC reports even stronger than previous:
 - Even less uncertainty regarding human causes and severe physical and social consequences of greenhouse gas emissions-based global warming
 - A series of major new reports have been released and more are scheduled; Monitor <http://ipcc.ch/> for ongoing updates
 - The Sixth Assessment Report is now underway, with reports beginning in 2021; see: <https://www.ipcc.ch/assessment-report/ar6/>

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Global Warming and Climate Change: Scope, Migration, and Adaptation



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Why this is Important for Economic Development in Particular: Severity of climate change consequences in SSA and South Asia

- IPCC reports have been a wake-up alarm – though the main response has been to repeatedly hit the snooze button...
- **IPCC warns of severe consequences:** droughts, desertification, storms, floods, heat waves, deteriorated water resources, reduced crop yields, spread of pests and diseases, sea level rises; loss of grasslands and farmlands
- **Sub-Saharan Africa** countries will be disproportionately drought-afflicted and suffer the worst impacts on agricultural productivity
- **South & Southeast Asia** will be disproportionately flood-affected
- **Pacific and Indian Ocean bordering states** within the cyclone belt will be disproportionately storm-afflicted.

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Some impacts of climate change in Developing Countries identified by IPCC working groups

- Adverse health impacts, including spreading of pests and disease
- Prolonged droughts, expanded desertification
- Increased severity of storms with heavy flooding and erosion
- Longer and more severe heat waves
- Reduced summer river flow and water shortages
- Agriculture harmed in tropical and subtropical areas
- Lost and contaminated groundwater
- Deteriorated freshwater lakes, coastal fisheries, mangroves, coral reefs
- Coastal flooding
- Loss of essential species such as pollinators and soil organisms,
- Forest and crop fires
- Resultant conflicts over natural resources

- In sum: impact of global warming likely hardest on the poorest

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Global Warming and Climate Change: Scope, Mitigation, and Adaptation

- **Historically, a problem mostly - but not exclusively - caused by developed countries**
- **Growing sources of emissions from developing countries**
 - Rapid industrial growth especially in Asia: coal plants, autos, etc.
 - Worsened by perverse policies e.g. fossil fuel subsidies
 - Deforestation in developing countries (about 20%+ of emissions)
- **Strategies for mitigation**
 - Taxes on carbons
 - Caps on greenhouse gases (generally with "carbon markets")
 - Subsidies to encourage technological progress
- **Types of adaptation**
 - Planned (or "policy") adaptation
 - Autonomous adaptation

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"Planned" and "Autonomous" Adaptation

- **Planned (or policy-driven) adaptation is undertaken by governments**
- **Autonomous adaptation is undertaken by individuals, families, communities; examples:**
 - Altering crop or livestock varieties
 - Changing livelihoods
 - Increasing exploitation of common pool resources
 - Moving locally (such as to higher ground)
 - Migrating temporarily or permanently within a country or internationally
- **Almost certainly, autonomous adaptation will be the predominant form of adaptation**
- **Good governance acts as a complement for autonomous adaptation (and, at least, avoids thwarting beneficial responses)**

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Planned/Autonomous Adaptation Interaction Tradeoffs

- **Example 1:** Addressing vulnerable low-lying land
 - Policies to vacate low-lying land in densely populated areas subject to inundation increase pressures on adjacent land, and increase conflict risks
 - In contrast, in some circumstances constructing barriers to protect low-lying land might avoid conflict risk
 - But building such barriers may also have unintended environmental, social, and economic consequences
- **Example 2:** Policies restricting migration within or across countries could avoid tensions and reduce conflict risks.
 - But restrictions could increase risks because migration acts as a key safety valve that represents one of the most important forms of autonomous adaptation

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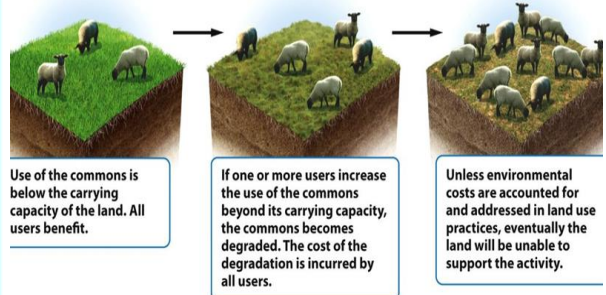
Economic Models of Environment *Issues: Common Property Resources*

- Inefficiencies may arise because a resource is not privately owned
- Too much labor used on the common property compared to other activities – the so-called tragedy of the commons
 - Sometimes referred to as “too many cows,” too many trees cut, too many fish caught, etc.
- Users fail to take account of an externality: that as each uses more of the common resource the average return is lowered for other users
- Possibly too little investment in the common resource, because others have access to some of the returns

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The Tragedy of the Commons



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The “Tragedy of the Commons”: Policy Options

- **Problem:** Overuse of, and underinvestment in, common property resources
- Direct, external government solution costly and likely ineffective in many cases. Two alternatives:
- **Traditional Economic Analysis Solution: Privatization**
 - Small farmers can benefit from extended tenancy or ownership
 - Small to medium resource firms
 - Larger firms could generate local employment; but community may lose benefits of the common resource and not be (fully) compensated
 - Traditional models do not directly address equity and income distribution
 - If privatize: Who should buy? (Encouraged/assisted with financing to buy traditionally owned land, that may now be nominally government-owned)
- **Alternative Solution:** Local social enforcement mechanisms

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Ostrom’s Common Property Design Principles: Details

- 1. Clearly defined boundaries**
 - The boundaries of the resource system (e.g., irrigation system or fishery) and the individuals or households with rights to harvest resource units are clearly defined
- 2. Proportional equivalence between benefits and costs**
 - Rules specifying the amount of resource products that a user is allocated are related to local conditions and to rules requiring labor, materials, and money inputs
- 3. Collective-choice arrangements**

Many of the individuals affected by the harvesting and protection rules are included in the group who can modify these rules
- 4. Monitoring**
 - Monitors, who actively audit biophysical conditions and user behavior, are at least partially accountable to the users or are the users themselves

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Ostrom's Common Property Design Principles: Details (Continued)

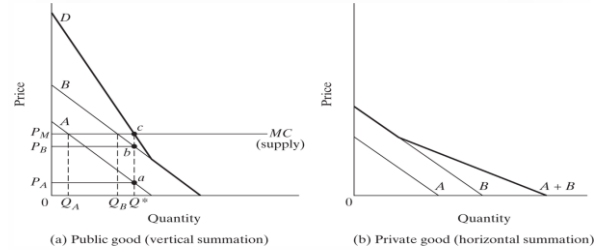
5. **Graduated sanctions**
 - Users who violate rules are likely to receive graduated sanctions (depending on the seriousness and context of the offense) from other users, from officials accountable to these users, or from both
6. **Conflict resolution mechanisms**
 - Users and their officials have rapid access to low-cost, local arenas to resolve conflicts among users or between users and officials
7. **At least minimal recognition of rights to organize**
 - The rights of users to devise their own institutions are not challenged by external governmental authorities, and users have long-term tenure rights to the resource
8. **For resources that are parts of larger systems: Nested enterprises**
 - Appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organized in multiple layers of nested enterprises

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Economic Models of Environment Issues (Continued)

- **Public goods and bads: regional environmental degradation and the free-rider problem**
 - Internalization of externalities is not easy
 - Free rider problems
- **Limitations of the public goods framework**
 - Pricing mechanism



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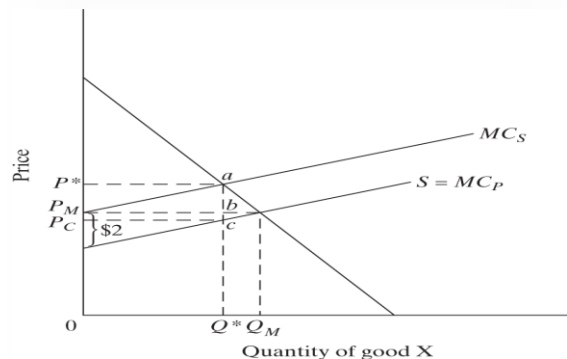
Urban Development and the Environment

- **Environmental Problems of Urban Slums**
 - Health threatening pollutants
 - Unsanitary environmental conditions
 - Serious impact on poor
- **Industrialization and urban air pollution**
 - Environmental Kuznets curve
 - Pollution tax
 - Absorptive capacity of the environment
 - Severity of industrial pollution- impact on health
- **Problems of congestion, Clean water, and Sanitation**
 - High health and economic costs associated
 - Drag on development
 - Impact on poor
 - Private wells have led to land subsidence and flooding
 - Impact on export earnings

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Pollution Externalities: Private Versus Social Costs and the Role of Taxation



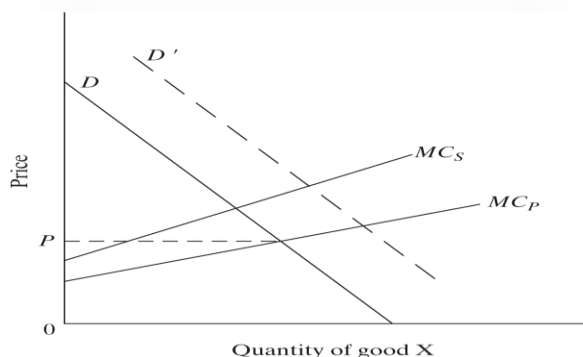
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Increasing Pollution Externalities with Economic Growth



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The Local and Global Costs of Rain Forest Destruction

- Rainforest loss contributes to global warming
- Loss of biodiversity
- Loss of livelihoods for people living in poverty who depend upon them
- Much waste in the process of forest clearing
- Thus, rainforest preservation (and restoration) is a global public good - a restorative mechanism for the environment
- Sustainable management of rain forests is a priority
- Provide funds, debt relief to help enhance biodiversity
- In addition, support for forest preservation as climate change mitigation

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Policy Options in Developing and Developed Countries

- **What Developing Countries can do**
 - Proper resource pricing
 - Community involvement
 - Clearer property rights and resource ownership
 - Improved economic alternatives for the poor
 - Improved economic status of women
 - Investments that yield returns regardless of the shape of climate change, such as a better road network
 - Industrial emissions abatement policies
 - Proactive stance toward adapting to climate change

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Policy Options in Developing and Developed Countries (Continued)

- **What developed countries can do for the global environment**
 - Emissions controls, including greenhouse gases
 - Research and Development on green technology and pollution control
 - Transfer of technology to developing countries
 - Restrictions on unsustainable production
- **Imbalance of global environmental impacts**
- **How developed countries can help developing countries**
 - Lower developing country costs for environmental preservation
 - Trade policies: reduce barriers, subsidies
 - Debt relief and debt for nature swaps
 - Development assistance

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Regulating Economies for Optimal Environmental Performance

- **Correcting market failures**
 - E.g. clarifying property regimes, supplying information, providing public goods, regulating monopolies
- **Correcting government failures**
 - E.g. removing perverse taxes and subsidies, proper CBA (cost-benefit analysis) for public investments
- **Regulation to set pollution at the “optimal” level**
 - **Command and control (e.g. standards)**
 - **Market-based instruments**
 - **Charges**
 - **Subsidies**
 - **Marketable permits**
 - **Others**
- **Other approaches**
 - **Voluntary incentives, education, planning, etc.**

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Environmental Economics and Ecological Economics

	Environmental economics	Ecological economics
Key original protagonists	David Pearce	Herman Daly, Robert Costanza
Key disciplinary influences	Neo-classical economics, natural resource economics	Ecosystem science, evolutionary systems theory, biophysical economics
Key calculative practices	Accounting, i.e. monetary valuation of environmental services, cost-benefit analysis, theory of externalities, intergenerational distribution of income given use of exhaustible resources, capital theory and monetary valuation	Ecosystems modelling, material and energy flows, ecological-economic joint modelling, biophysical valuation - nonetheless opened to market valuation
Versions of 'sustainability'	'weak', i.e. maintenance of aggregate stock of capital required, but commensurability and substitutability between different forms of capital are possible, thus manufactured capital can replace natural capital	'strong', i.e. natural capital cannot be substituted by other forms of capital: '[n]atural capital can never be entirely replaced by any combination of human labor, wealth, and technology' (Prugh et al., 1999, xvi)

https://www.researchgate.net/figure/Natural-capital-tendencies-in-environmental-and-ecological-economics-after-Akerman_681_313574665

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Comparison of Three Major Environmental Worldviews

Environmental Worldviews

Planetary Management

- We are apart from the rest of nature and can manage nature to meet our increasing needs and wants.
- Because of our ingenuity and technology, we will not run out of resources.
- The potential for economic growth is essentially unlimited.
- Our success depends on how well we manage the earth's life-support systems mostly for our benefit.

Stewardship

- We have an ethical responsibility to be caring managers, or stewards, of the earth.
- We will probably not run out of resources, but they should not be wasted.
- We should encourage environmentally beneficial forms of economic growth and discourage environmentally harmful forms.
- Our success depends on how well we manage the earth's life-support systems for our benefit and for the rest of nature.

Environmental Wisdom

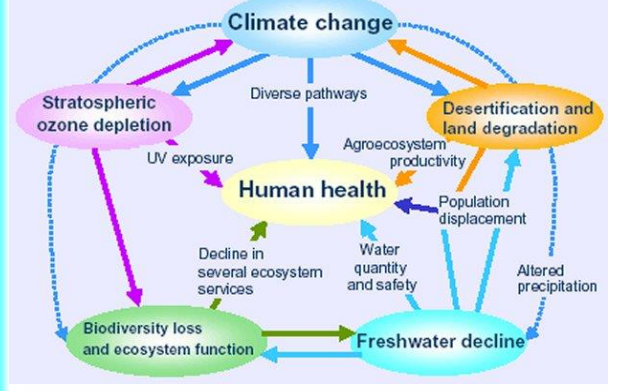
- We are a part of and totally dependent on nature, and nature exists for all species.
- Resources are limited and should not be wasted.
- We should encourage earth-sustaining forms of economic growth and discourage earth-degrading forms.
- Our success depends on learning how nature sustains itself and integrating such lessons from nature into the ways we think and act.

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What are Your Thoughts?



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