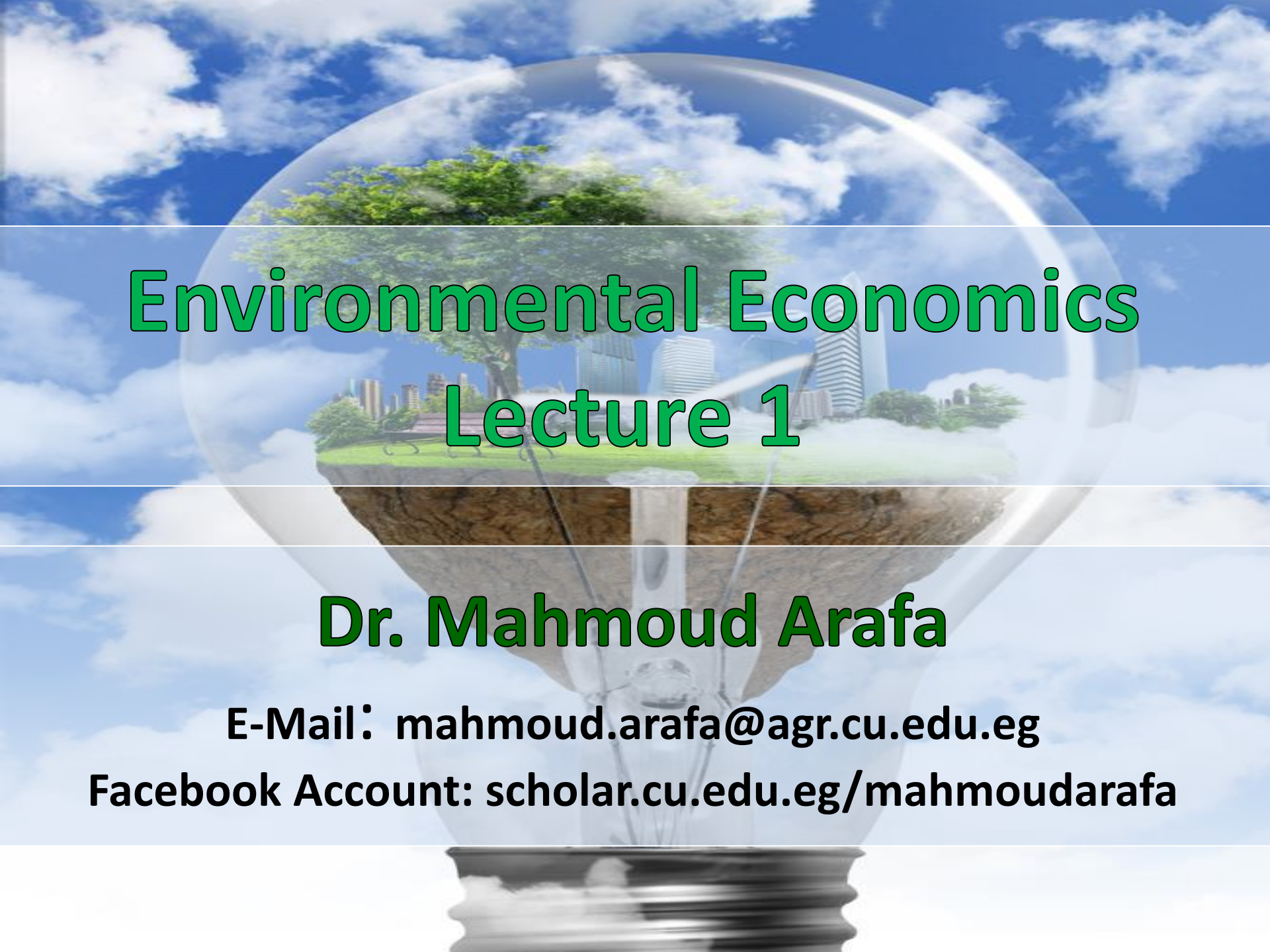

Environmental Economics
Lecture 1

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Define

Economic ?

Efficiency Consumer's Choice Efficient Market Producer's Surplus,

Externalities Market Failure Scarcity Consumer's Surplus,

Public Goods Cost-Benefit Analysis Discount Rates Social Benefit

Welfare Analysis Equilibrium Supply Demand Private Benefit

What is Environmental **Economics**?

Economics is the study of the allocation of scarce resources.

Economics：the study of how humans satisfy their needs and desires

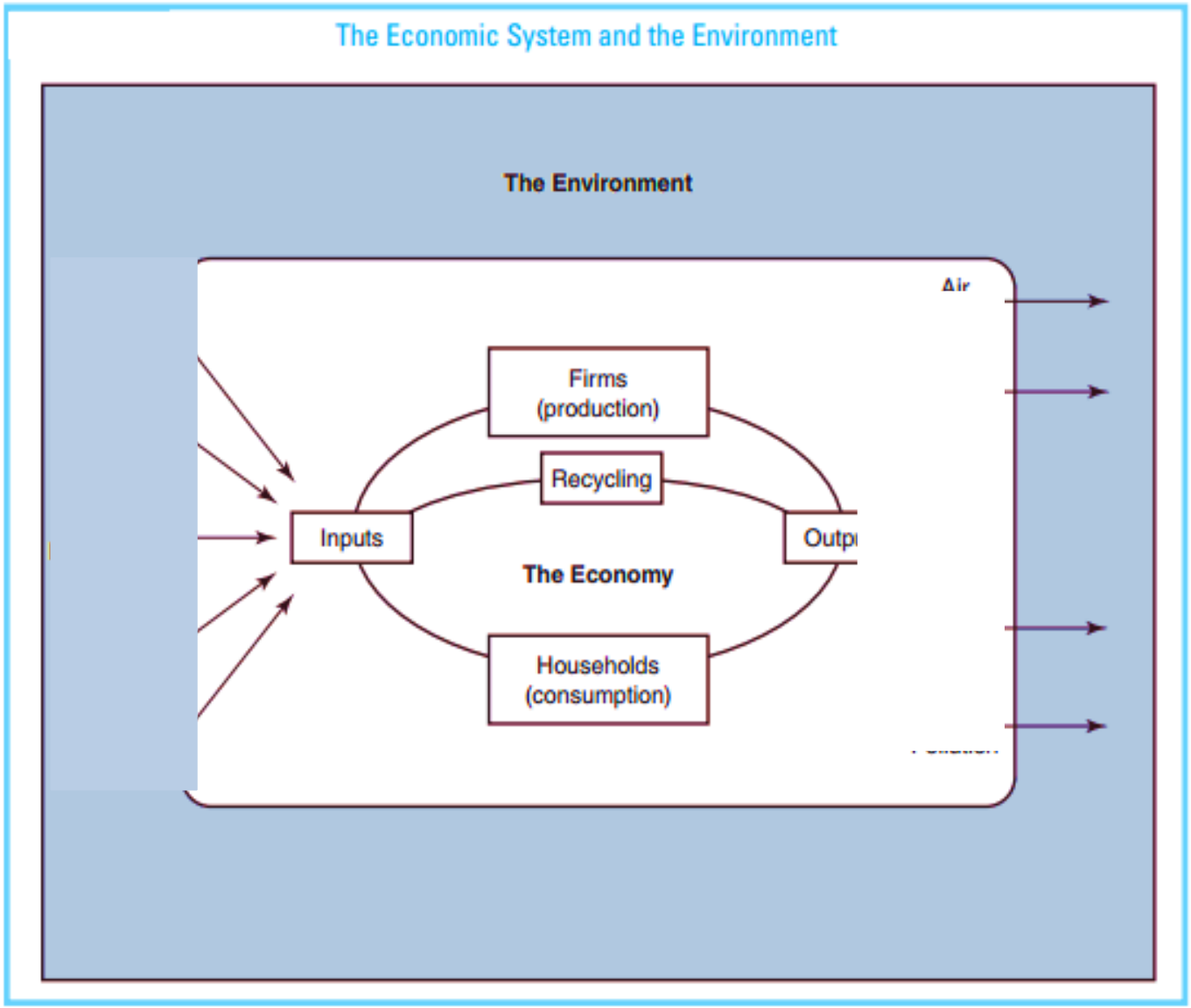
Economics helps us to know

-how much money society should spend on environmental quality and how environmental policies should be structured.

Economics helps us to understand

- The **value** of pollution abatement.
- The **costs** of pollution abatement.
- The **welfare effects** of different policies to control pollution.

The relationship between Economic and Environment



This Chapter Focus on

- **What major environmental issues do we face?**

- **How can economics help us understand these issues?**

- **How do economic and Environmental differ, and how can we combine them to address environmental issues?**

Microeconomic & macroeconomic

The prefix "micro-" means "small," so **microeconomics is the study of small economic units.**

Macroeconomics is the "big picture" version of economics. Rather than analyzing individual markets, **macroeconomics focuses on aggregate production and consumption in an economy**.

Microeconomics concerns with ..

* Consumer decision making and utility maximization

* Firm production and profit maximization

* Individual market equilibrium

* Effects of government regulation on individual markets

* Externalities and other market side effects

Macroeconomics concerns with ..

* The effects of general taxes system such as income and sales taxes on output and prices.

* The causes of economic upswings and downturns (Economic cycles).

* The effects of monetary and fiscal policy on economic.

* How interest rates are determined.

* Why some economies grow faster than others.

Two Approaches

There are two approaches in addressing natural resource and environmental economics.

1. The Traditional Economic Approach

2. The Ecological Economics Approach

1. The Traditional Economic Approach

This approach uses a set of models and techniques rooted within the standard neoclassical economic thought to **apply economic concepts to the environment.**

2. The Ecological Economics Approach

Rather than applying economic concepts *to* the environment, **ecological economics seeks to place economic activity *in the context of* the biological and physical systems that support life**, including all human activities.

Ecological and Environmental Economics

Ecological economics: the study of the human economy as part of nature's economy.

Environmental economics: the specialization within neoclassical economics that is concerned with the economy's insertions into the natural environment.

The Traditional Economic Approach

Microeconomic

Environmental

Macroeconomic

Environmental Microeconomics

Microeconomic and Valuation Techniques

1. Measuring external costs and benefits

"External" means "outside. … "outside" means outside of any buying and selling among people or firms.

An **external cost** is a cost that a producer or a consumer imposes on another producer or consumer, outside of any market transaction between them.

If there is an external cost on you, you are giving something up without receiving any agreed-upon payment.

Pollution of air or water is the prime example of an external cost.

Microeconomic and Valuation Techniques

1. Measuring external costs and benefits

An **external benefit** is a benefit that someone gains because of someone else's action, outside of any market transaction between them.

fortifications give external benefits. When you get a vaccine for a certain disease, you make it less likely that you will contract the disease. That is the internal benefit.

What you also do ? is make is less likely that other people will get the disease, because they probably will not catch it from you.

Microeconomic and Valuation Techniques

1. Measuring external costs and benefits

for example, estimating a money value for damage caused (Cost) by acid rain pollution.

This value can then be compared to the costs of correcting the problem through pollution control technology or reduced output of polluting activities.
We can **internalize externalities** through …

Tax **on the polluting activity.**

Microeconomic and Valuation Techniques

2. Valuing resources and the environment as assets

Valuing resources and the environment as assets requires Economic valuation technique. The standard economic technique to balance present and future benefits/costs is to use a **discount rate**.

In this technique, a **present** benefit/cost receives a somewhat **higher** value than a **future** benefit/cost

Discount Rate

$$DR = \frac{1}{1 + r^{n}}$$

$$PV = \frac{1}{1 + r^{n}} * FV$$

$$PV = \frac{FV}{1 + r^{n}}$$

Some Economic Valuation techniques

B/C Ratio

NPV

IRR

B/C Ratio

$$B/C = \sum \frac{BPV}{CPV} = \sum \frac{BFV * DR}{CFV * DR}$$

Calculate B/C for the following project at the rate (r) of 10% .

Years	Benefit	Cost
0	0	150
1	200	100
2	300	100
3	400	100

Discount Rate																
Period	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	Period
1	0.9901	0.9804	0.9709	0.9615	0.9524	0.9434	0.9346	0.9259	0.9174	0.9091	0.9009	0.8929	0.8850	0.8772	0.8696	1
2	0.9803	0.9612	0.9426	0.9246	0.9070	0.8900	0.8734	0.8573	0.8417	0.8264	0.8116	0.7972	0.7831	0.7695	0.7561	2
3	0.9706	0.9423	0.9151	0.8890	0.8638	0.8396	0.8163	0.7938	0.7722	0.7513	0.7312	0.7118	0.6931	0.6750	0.6575	3
4	0.9610	0.9238	0.8885	0.8548	0.8227	0.7921	0.7629	0.7350	0.7084	0.6830	0.6587	0.6355	0.6133	0.5921	0.5718	4
5	0.9515	0.0328	0.8626	0.8219	0.7835	0.7473	0.7130	0.6806	0.6499	0.6209	0.5935	0.5674	0.5428	0.5194	0.4972	5
6	0.0161	0.0176	0.8375	0.7903	0.7462	0.7050	0.6663	0.6302	0.5963	0.5645	0.5346	0.5066	0.4803	0.4556	0.4323	6
7	0.9327	0.0096	0.8131	0.7599	0.7107	0.6651	0.6227	0.5835	0.5470	0.5132	0.4817	0.4523	0.4251	0.3996	0.3759	7
8	0.9235	0.0053	0.7894	0.7307	0.6768	0.6274	0.5820	0.5403	0.5019	0.4665	0.4339	0.4039	0.3762	0.3506	0.3269	8
9	0.9143	0.7477	0.7664	0.7026	0.6446	0.5919	0.5439	0.5002	0.4604	0.4241	0.3909	0.3606	0.3329	0.3075	0.2843	9
10	0.9053	0.8401	0.7441	0.6756	0.6139	0.5584	0.5083	0.4632	0.4224	0.3855	0.3522	0.3220	0.2946	0.2697	0.2472	10
11	0.8963	0.9004	0.7224	0.6496	0.5847	0.5268	0.4751	0.4289	0.3875	0.3505	0.3173	0.2875	0.2607	0.2366	0.2149	11
12	0.8874	0.7885	0.7014	0.6246	0.5568	0.4970	0.4440	0.3971	0.3555	0.3186	0.2858	0.2567	0.2307	0.2076	0.1869	12
13	0.8787	0.7730	0.6810	0.6006	0.5303	0.4688	0.4150	0.3677	0.3262	0.2897	0.2575	0.2292	0.2042	0.1821	0.1625	13
14	0.8700	0.7579	0.6611	0.5775	0.5051	0.4423	0.3878	0.3405	0.2992	0.2633	0.2320	0.2046	0.1807	0.1597	0.1413	14
15	0.8613	0.7430	0.6419	0.5553	0.4810	0.4173	0.3624	0.3152	0.2745	0.2394	0.2090	0.1827	0.1599	0.1401	0.1229	15
16	0.8528	0.7284	0.6232	0.5339	0.4581	0.3936	0.3387	0.2919	0.2519	0.2176	0.1883	0.1631	0.1415	0.1229	0.1069	16
17	0.8444	0.7142	0.6050	0.5134	0.4363	0.3714	0.3166	0.2703	0.2311	0.1978	0.1696	0.1456	0.1252	0.1078	0.0929	17
18	0.8360	0.7002	0.5874	0.4936	0.4155	0.3503	0.2959	0.2502	0.2120	0.1799	0.1528	0.1300	0.1108	0.0946	0.0808	18
19	0.8277	0.6864	0.5703	0.4746	0.3957	0.3305	0.2765	0.2317	0.1945	0.1635	0.1377	0.1161	0.0981	0.0829	0.0703	19
20	0.8195	0.6730	0.5537	0.4564	0.3769	0.3118	0.2584	0.2145	0.1784	0.1486	0.1240	0.1037	0.0868	0.0728	0.0611	20
21	0.8114	0.6598	0.5375	0.4388	0.3589	0.2942	0.2415	0.1987	0.1637	0.1351	0.1117	0.0926	0.0768	0.0638	0.0531	21
22	0.8034	0.6468	0.5219	0.4220	0.3418	0.2775	0.2257	0.1839	0.1502	0.1228	0.1007	0.0826	0.0680	0.0560	0.0462	22
23	0.7954	0.6342	0.5067	0.4057	0.3256	0.2618	0.2109	0.1703	0.1378	0.1117	0.0907	0.0738	0.0601	0.0491	0.0402	23
24	0.7876	0.6217	0.4919	0.3901	0.3101	0.2470	0.1971	0.1577	0.1264	0.1015	0.0817	0.0659	0.0532	0.0431	0.0349	24
25	0.7798	0.6095	0.4776	0.3751	0.2953	0.2330	0.1842	0.1460	0.1160	0.0923	0.0736	0.0588	0.0471	0.0378	0.0304	25
26	0.7720	0.5976	0.4637	0.3607	0.2812	0.2198	0.1722	0.1352	0.1064	0.0839	0.0663	0.0525	0.0417	0.0331	0.0264	26
27	0.7644	0.5859	0.4502	0.3468	0.2678	0.2074	0.1609	0.1252	0.0976	0.0763	0.0597	0.0469	0.0369	0.0291	0.0230	27
28	0.7568	0.5744	0.4371	0.3335	0.2551	0.1956	0.1504	0.1159	0.0895	0.0693	0.0538	0.0419	0.0326	0.0255	0.0200	28
29	0.7493	0.5631	0.4243	0.3207	0.2429	0.1846	0.1406	0.1073	0.0822	0.0630	0.0485	0.0374	0.0289	0.0224	0.0174	29
30	0.7419	0.5521	0.4120	0.3083	0.2314	0.1741	0.1314	0.0994	0.0754	0.0573	0.0437	0.0334	0.0256	0.0196	0.0151	30

Years	Benefit	Cost	DR	B	C
0	0	150	1	0	150
1	200	100	0.909	181.8	90.9
2	300	100	0.826	247.8	82.6
3	400	100	0.751	300.4	75.1
			∑=	730	399
				B/C=	1.831

$$B/C = \sum \frac{BPV}{CPV} = \sum \frac{BFV * DR}{CFV * DR}$$

Net Present Value - NPV

NPV compares the value of a dollar today to the value of that same dollar in the future, taking inflation and returns into account.

If the NPV of a prospective project is positive, it should be accepted.

if NPV is negative, the project should probably be rejected because cash flows will also be negative.

$$NPV = \sum \left[\left(\frac{BFV}{(1+r)^n} \right) - \left(\frac{CFV}{(1+r)^n} \right) \right]$$

NPV

Years	Benefit	Cost	DR	B	C
0	0	150	1	0	150
1	200	100	0.909	181.8	90.9
2	300	100	0.826	247.8	82.6
3	400	100	0.751	300.4	75.1
			∑=	730	399
				NPV=	+331.4

$$NPV = \sum\left[\left(\frac{BFV}{(1+r)^n}\right)-\left(\frac{CFV}{(1+r)^n}\right)\right]$$

IRR

$$IRR = R_1 + \frac{NPV_1 * (R_2 - R_1)}{NPV_1 + |NPV_2|}$$

Years	Benefit	Cost	DR 10%	B	C	NPV1	
0	0	150	1	0	150	-150	
1	200	100	0.909	181.8	90.9	90.9	
2	300	100	0.826	247.8	82.6	165.2	
3	400	100	0.751	300.4	75.1	225.3	
						331.4	

Years	Benefit	Cost	DR 15%	B	C	NPV2	
0	0	150	1	0	150	-150	
1	200	100	0.869	173.8	86.9	86.9	
2	300	100	0.756	226.8	75.6	151.2	
3	400	100	0.657	262.8	65.7	197.1	
						285.2	

DR 15%	B	C	NPV1	NPV2
1	0	150	-150	-150
0.869	173.8	86.9	90.9	86.9
0.756	226.8	75.6	165.2	151.2
0.657	262.8	65.7	225.3	197.1
			331.4	285.2

$$IRR = 10 + \frac{331.4 * (15 - 10)}{331.4 + |285.2|} = 12.7\%$$

Note

The question here to compare between to projects first as the previous, and the second which imposed 3-5% (for example) pollution tax .

Resolve the example supposing that the government impose 10% pollution tax on **C**. And are you accept the pollution tax on your project?

Note that: first R=10%, and the second is 15%

Microeconomic and Valuation Techniques

3. Devising appropriate **property rights rules** for environmental resources and establishing rules for use of common property resources and for provision of public goods.

Ruth Bader Ginsburg Will Retire When She Wants

By Garrett Epps

The Toxins That Threaten Our Brains

By James Hamblin

The Secret Lives of Inner-City Black Men

By Ta-Nehisi Coates

How Property Rights Could Help Save the Environment

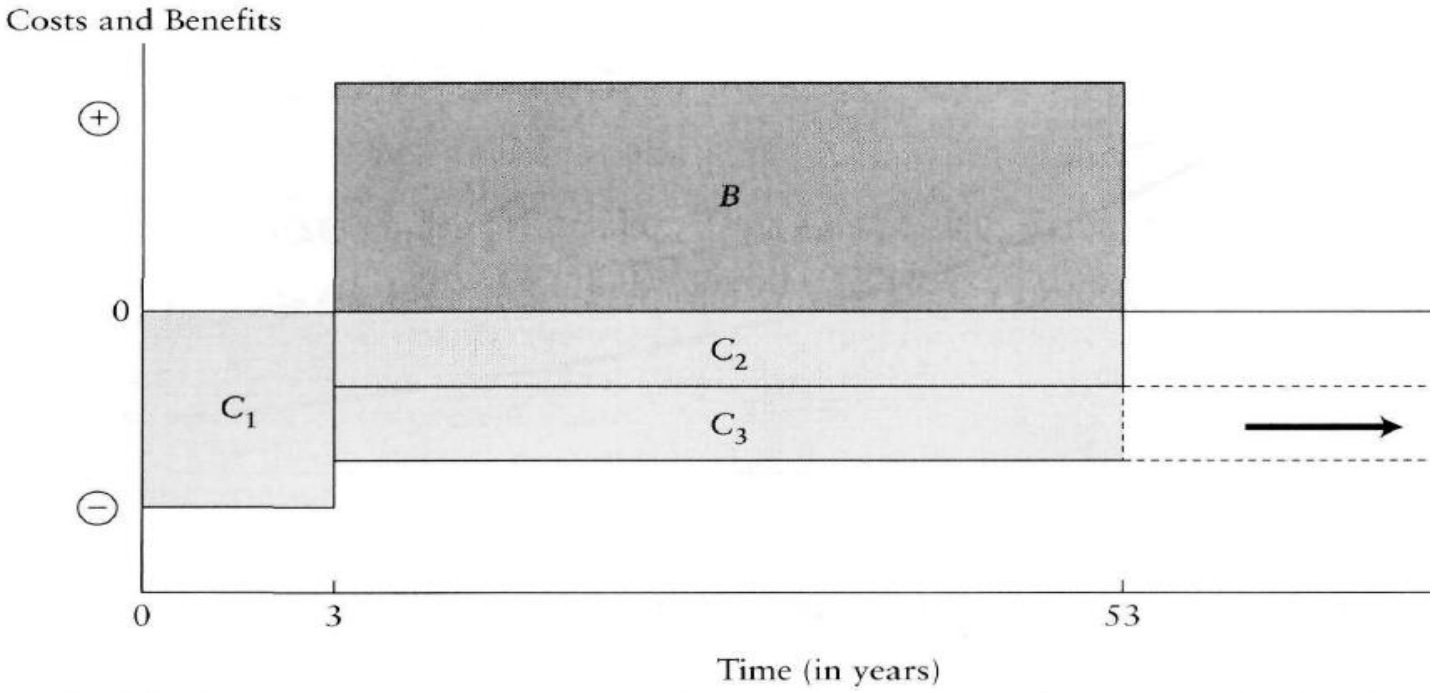
MEGAN MCARDLE | MAY 29 2012, 9:10 AM ET

http://www.theatlantic.com/business/archive/2012/05/how-property-rights-could-help-save-the-environment/257756/

In my past two posts I've made a brief case for approaching environmental proble hat Garret it) as a solutio of approa a second post I discussed how the recognition of property rights in fisheries have, in fact, prevented the tragedy of the commons in marine fisheries. This is because

assignment

4. Cost-Benefit analysis.



C_1 = Construction Costs
C_2 = Operating Costs
C_3 = Environmental and Social Costs
B = Benefits

$$\text{NPV} = \sum_{i=4}^{53} B / (1+r)^i - \sum_{i=1}^{3} C_{1i} / (1+r)^i - \sum_{i=4}^{53} C_{2i} / (1+r)^i - \sum_{i=4}^{\infty} C_{3i} / (1+r)^i$$

r = discount rate

Summary

Microeconomic and Valuation Techniques

1. external costs and benefits
2. discount rate
3. property rights rules
4. cost-benefit analysis

WEBSITES

1. **http://www.worldwatch.org/** The homepage for the Worldwatch Institute, an organization that conducts a broad range of research on environmental issues. The Worldwatch annual "State of the World" report presents detailed analyses of current environmental issues.

2. **http://www.ncseonline.org/** Website for the National Council for Science and the Environment, with links to various sites with state, national, and international data on environmental quality.

3. **http://www.emagazine.com/** Website for E/The Environmental Magazine. The site includes many archived articles on all environmental topics.

4. **http://www.unep.org/geo/geo3/** Website for the Global Environment Outlook-3, a United Nations publication. The report is an extensive analysis of the global environmental situation.