Environment and Development.

Concepts and measures in environment and development.

First, why are these two ideas linked?

Both are by their nature dynamic processes that interact.

Environment can be seen as a source of the raw material for development (agriculture accounts for over 50% of employment)

Environment impacted by the process of growth (think of air pollution and urbanization).

Until the 1980's, the debate tended to pit "conservationists" against "developmentalists" in development dialog.

"Limits to Growth", Meadows et al. 1972.

Response was growth theory incorporating natural resource stocks as a form of capital.

The Bruntland Commission Report of 1987, in what is probably the most commonly cited definition of sustainable development, defines the concept as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs".

Pezzy and Toman (2002) provide a nice summary of the economic literature on sustainable development.

Pezzy and Toman report that a "key finding from Dasgupta and Heal's 1974 analysis was that the PV-optimal outcome is grim for far-distant generations." (p.6)

Estimate by Costanza et al. (1997) of the annual flow of goods and services from the environment. 33 trillion. In contrast, annual GDP in 1997 was around 20 trillion.

The problem is discounting. Stiglitz, Solow also weighed in. Later, overlapping generation (OLG) models. Issue goes beyond equity to involve issues of fairness to future generations.

A key issue identified by Pezzy and Toman is the distinction between "weak sustainability" and "strong sustainability" in the literature.

The difference revolves around the question of whether substitution between human made capital and natural resources are limited (if so, then the focus is on strong sustainability) or unlimited (the focus is weak sustainability).

That is, is it acceptable to return to future generations manufactured capital of a given value instead of a commensurate level of natural capital? Could we wipe out the whales, put the money in the bank, and have it return capital to the future?

World Development 1992 report. Development or environmental quality is a false dichotomy. Complementary aspects of the same agenda.

Without adequate environmental protection, development will be undermined.

Without development, environmental protection will fail.

“win-win” policies are the objective in this case. “Tradeoffs vs. synergies”.

Increasing emphasis on environmental management as a policy goal for developing country governments.

Reducing poverty and reducing environmental degradation are logically linked. Poor driven to degrade. Addressing poverty will address environmental degradation. “Poverty-environment nexus”

For example, improve agricultural productivity, less need to use currently uncultivated land. (land sparing argument)

However, how much of the environmental damage is being done by the wealthy, not the poor?

Growing field of bioeconomic modeling.

Economic decision model embedded in the evolution of the ecosystem. Answer specific questions for an environmentally defined area.

Allow predictions about how a system will evolve, and simulation methods to predict how the path may change if a parameter changes (particularly if a policy relevant variable changes).

Back on the macro side, we can consider environmental accounting / green accounting.

Is it sensible that if you chop down the forest and sell the trees there is only a positive impact on GNP? That is, you sell it today, you can't sell it tomorrow, so you take away tomorrow's GNP to increase today's. Plus maybe you chop down the trees and the soil runs off, also losing future potential GNP.

Or if you build a factory, and produce things that contribute to GNP, should we not also reduce GNP by the value of the damage to the ecosystem if there is damage?

Developing "greener" national accounts places environmental problems into a framework that key economic ministries in any government will understand.

The prominent indicators linking the macro-economy and the environment are measures of:

- "green" Net National Product (green NNP) -- The NNP measures the annual flow of economic production, based on market transactions, minus the value of depreciated capital (around 10% or so). It thereby leaves out the impact of economic activity on a very important national asset - natural capital. Green NNP accounts for degradation and depletion of natural capital.

NNP*=GNP-depreciation of manufactured capital assets – depreciation of environmental capital.

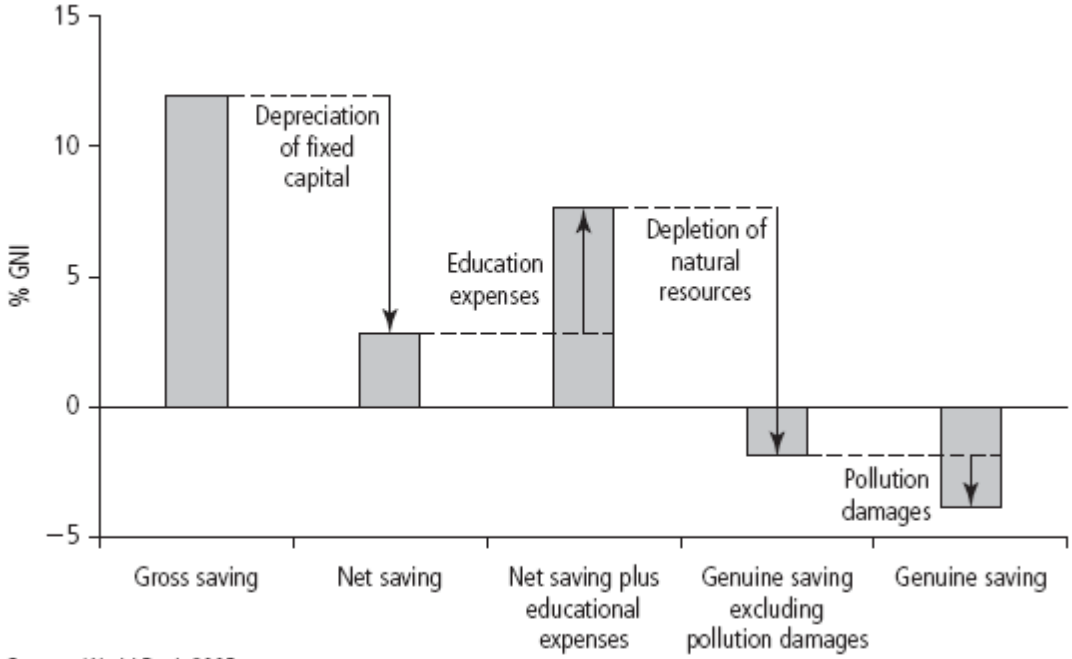
- adjusted net saving (formerly called genuine saving) -- Building on the same concept as the NNP, adjusted net saving measure the true rate of savings in an economy after taking into account depletion of natural resources and damage caused by pollution. Adjusted net saving is the true saving rate in a country after accounting for investments in human capital, depreciation of produced assets, and the depletion and degradation of the environment.

	Savings rate	Physical capital dep rate	Natural capital dep rate	Net savings
Sustainable				
Brazil	20	7	10	+3
US	18	12	3	+3
Costa Rica	26	3	8	+15
Marginal				
Mexico	24	12	12	0
Unsustainable				
Ethiopia	3	1	9	-7
Malawi	8	7	4	-3

Pearce and Atkinson, 1995

World Bank, 2006: Where is the Wealth of Nations?

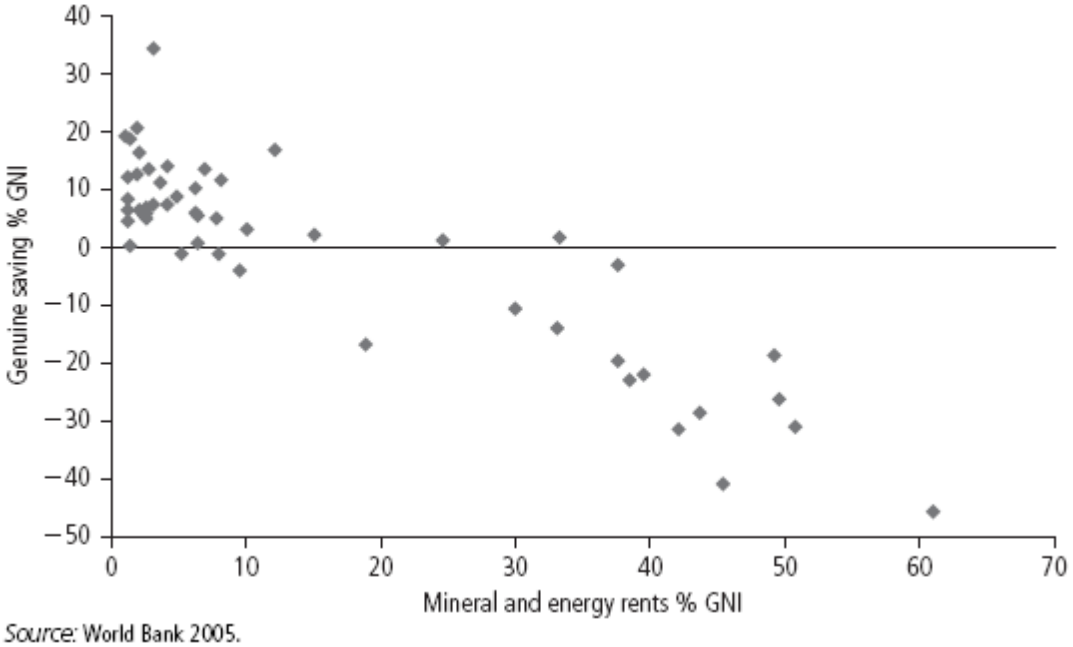
Figure 3.2 Adjustments in the Genuine Saving Calculation for Bolivia (2003)



Source: World Bank 2005.

World Bank Where is the Wealth of Nations page 40

Figure 3.4 Genuine Saving and Exhaustible Resource Share (share 2003)



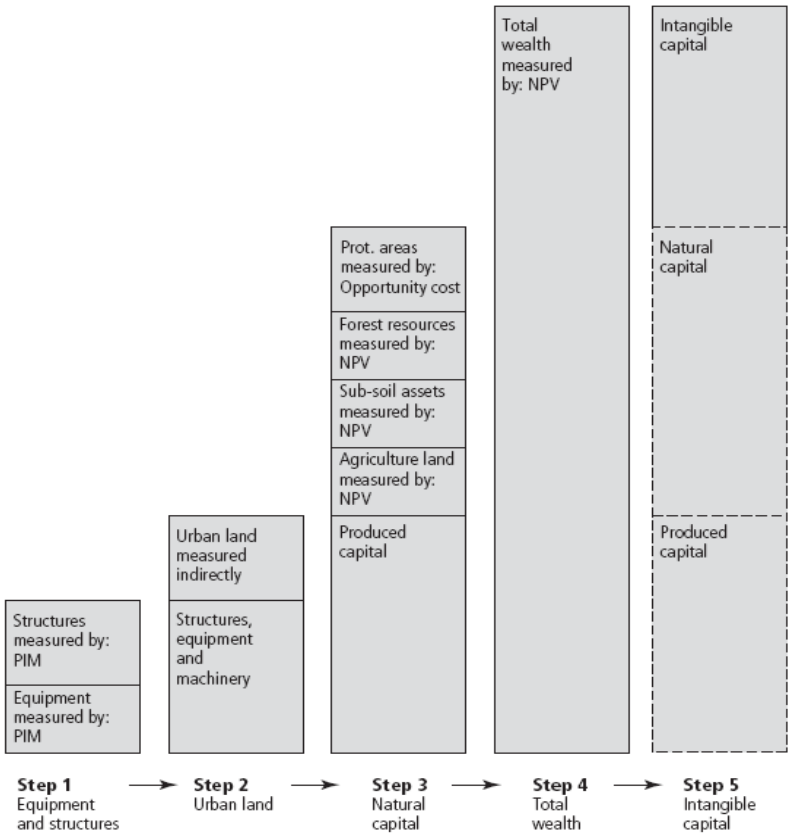
Source: World Bank 2005.

(page 43)

How do you measure the value of natural capital, and how do you measure its change?

- wealth accounting -- Another type of green accounting, this is the Bank's analysis of estimates of the wealth of nations, exploring the composition of wealth at a point in time

Figure 2.1 Estimating the Components of Wealth



The next step is the measurement of total wealth. Measuring total wealth as the sum of its components makes intuitive sense, but this is limited by data and methodological constraints. We have few good tools for valuing human capital, for example, and even fewer for valuing social or institutional capital. In other cases, such as fisheries, we simply lack data. The alternative is to rely on economic theory, which defines total wealth as the net present value of future consumption. We therefore measure total wealth by assuming a future consumption stream and calculating the net present value in year 2000. However, some countries have unsustainable levels of consumption, which is signaled by negative net or genuine saving levels (see chapter 3). In these cases consumption is decreased by the amount of negative saving in order to arrive at a sustainable level of consumption.

(page 23)

Since many wealth components are estimated as a net present value of a flow of benefits, the calculations require assumptions regarding the time horizon and the discount rate. Throughout the calculations, we assumed a time horizon of 25 years, which coincides roughly with a human generation. So, for example, total wealth is calculated as the net present value of sustainable consumption from the year 2000 to 2025. With respect to discounting, since the focus is on sustainable development, the discount rate used is the one a government would choose in allocating resources across generations. This is an argument in favor of using a social discount rate instead of a private discount rate. Estimates of the Social Rate of Return on Investment (SRRI—another name for the social discount rate) for industrialized countries report values between 2 and 4 percent (Pearce and Ulph 1999). We assume an SRRI at the upper limit, 4 percent. This would likely be too low for fast-growing economies such as China, while being high for slow-growing economies in Sub-Saharan Africa. We choose a single discount rate for all countries in order to facilitate comparisons.

(page 25)

Total Wealth, 2000 ($ per capita and percentage shares)

Income group	Natural capital	Produced capital + urban land	Intangible capital	Total wealth	Natural share	Produced share	Intangible capital share
Low-income countries	1,925	1,174	4,434	7,532	26%	16%	59%
Middle-income countries	3,496	5,347	18,773	27,616	13%	19%	68%
High-income OECD countries	9,531	76,193	353,339	439,063	2%	17%	80%
World	4,011	16,850	74,998	95,860	4%	18%	78%

Notes: All dollars at nominal exchange rates. Oil states are excluded. (OECD) Organisation for Economic Co-operation and Development
Source: Where is the Wealth of Nations, World Bank 2006

Table 1.3 Factors Explaining the Intangible Capital Residual

Factor	Elasticity		
School years per capita	0.53	R-squared	0.89
Rule of law index	0.83		
Remittances per capita	0.12		

Source: Authors.
Note: Coefficients are significant at the 5 percent level.

Table 1.4 Marginal Returns to Different Factors

Income group	School years per capita	Rule of law index	Remittances per capita
Low-income countries	838	111	29
Middle-income countries	1,954	404	39
High-income countries (OECD)	16,430	2,973	306

Source: Authors.
Note: Figures represent the increase in the intangible capital residual associated with a 1-unit increase in the given factor.

(page 13)

https://openknowledge.worldbank.org/entities/publication/e1399ed3-ebe2-51fb-b2bc-b18a7f1aaaed

Table 2.1 Total Wealth: Top-10 Countries, 2000

Country (descending order of per capita wealth)	Wealth per capita ($)	Natural capital (%)	Produced capital (%)	Intangible capital (%)
Switzerland	648,241	1	15	84
Denmark	575,138	2	14	84
Sweden	513,424	2	11	87
United States	512,612	3	16	82
Germany	496,447	1	14	85
Japan	493,241	0	30	69
Austria	493,080	1	15	84
Norway	473,708	12	25	63
France	468,024	1	12	86
Belgium-Luxembourg	451,714	1	13	86

Source: Where is the Wealth of Nations, World Bank 2006

Table 2.2 Total Wealth: Bottom-10 Countries, 2000

Country (descending order of per capita wealth)	Wealth per capita ($)	Natural capital (%)	Produced capital (%)	Intangible capital (%)
Madagascar	5,020	33	8	59
Chad	4,458	42	6	52
Mozambique	4,232	25	11	64
Guinea-Bissau	3,974	47	14	39
Nepal	3,802	32	16	52
Niger	3,695	53	8	39
Congo, Rep. of	3,516	265	180	–346
Burundi	2,859	42	7	50
Nigeria	2,748	147	24	–71
Ethiopia	1,965	41	9	50

Source: Where is the Wealth of Nations, World Bank 2006

2021 update
https://openknowledge.worldbank.org/entities/publication/e1399ed3-ebe2-51fb-b2bc-b18a7f1aaaed

What is the relationship between environmental degradation and economic growth – can growth cause and then prevent environmental damage?

Environmental Kuznets curve, where instead of inequality on the y-axis, we put a measure of an environmental ‘bad’.

Inverted U shaped curve between environmental degradation and income per capita.

As incomes rise, environmental impact rises.

When incomes rise enough, begin to address pollution issues, and environmental degradation will decline.

Economic growth will eventually address the negative environmental impact of the early phases of growth.

Environmental quality is a “luxury good” that we will address when we can afford it.

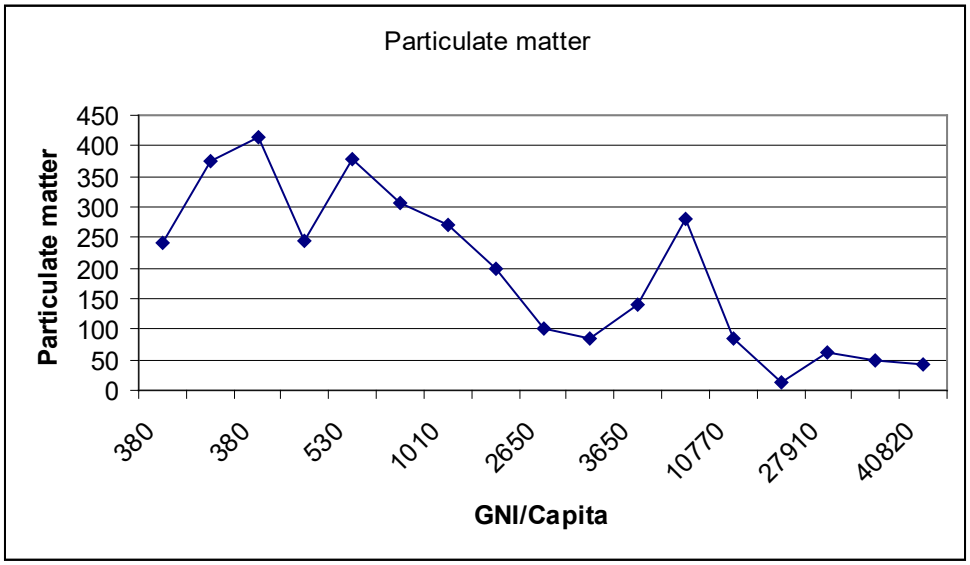
Supply side – we can afford the regulation when richer.

“Grow first, clean up later”

Holds for a subset of environmental measures (airborne pollutants for example). For other measures, it does not hold.

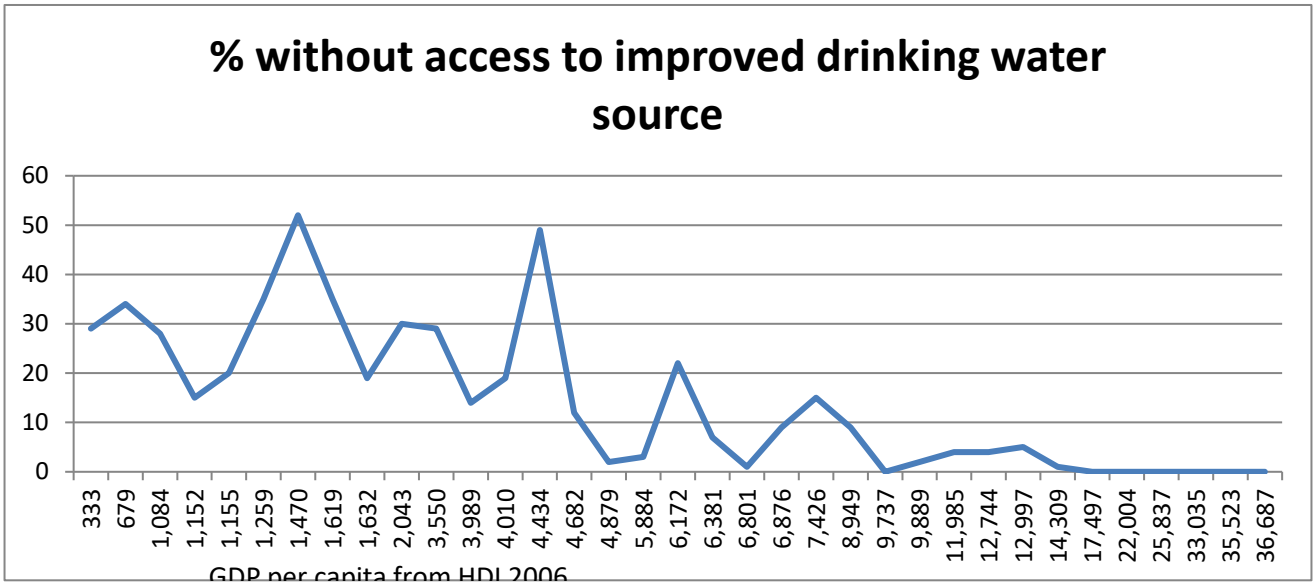
Table 10.1 Particulate air pollution in the largest cities, 1995

Country	City	City population (thousands)	SPM, micrograms per m^3
Brasil	San Paolo	16,533	86
	Rio de Janeiro	10,187	139
China	Shangkhai	13,584	246
	Beijing	11,299	377
	Tianjin	9,415	306
Egypt	Cairo	9,690	-
France	Paris	9,523	14
India	Mumbai	15,138	240
	Calcutta	11,923	375
	Dehli	9,948	415
Indonesia	Jakarta	8,621	271
Japan	Tokyo	26,959	49
	Osaka	10,609	43
Korea, Rep.	Seoul	11,609	84
Mexico	Mexico	16,562	279
Philippines	Manila	9,286	200
Russia	Moscow	9,269	100
Turkey	Istanbul	7,911	-
Great Britain	London	7,640	-
USA	New York, 1987-1990	16,332	61
	Los Angeles	12,410	-

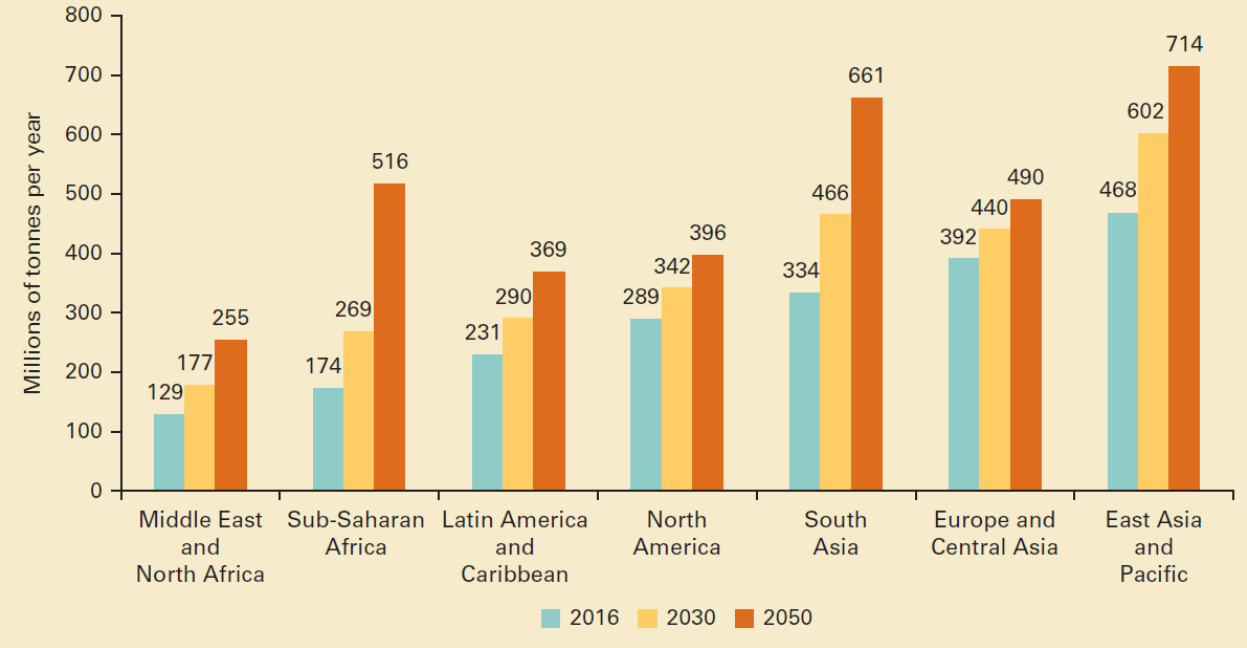


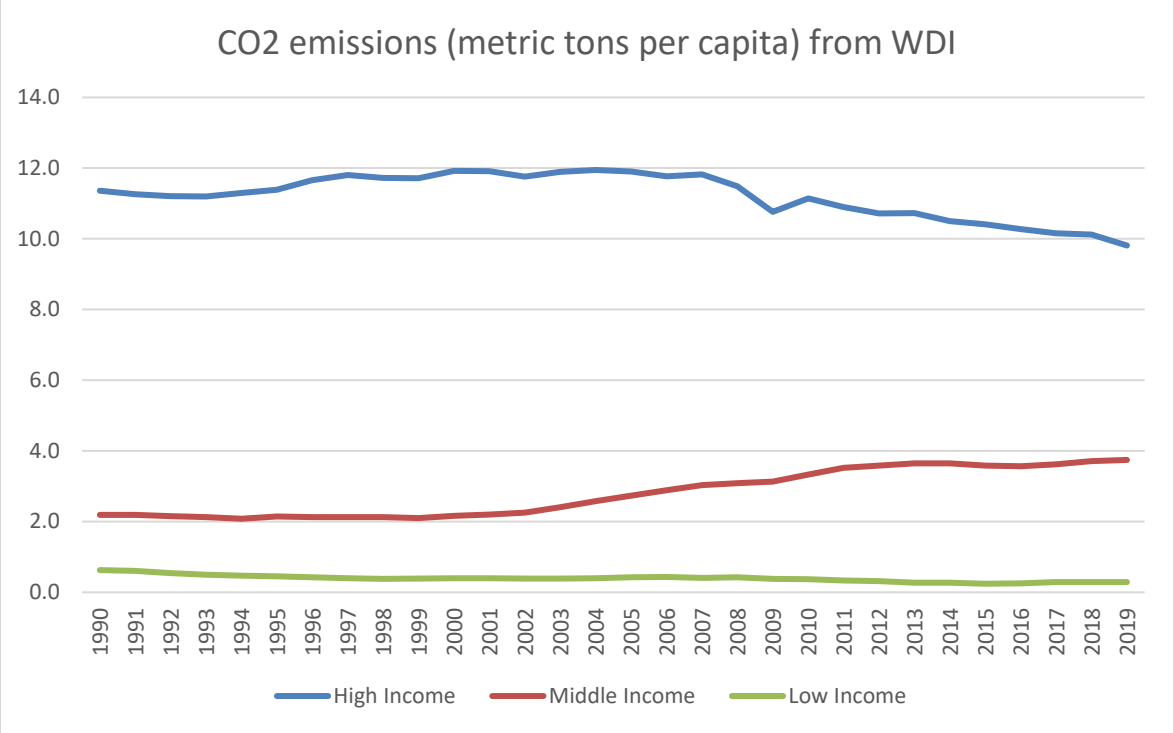
World Bank
(WHO suggests less than 90 is safe)

Some, downward trend in environmental bad as income increases without much evidence of an initial increase.
Population with unsafe water



Some, upward trend. Waste per capita, carbon dioxide emissions. *Projected waste generation, by region (millions of tonnes/year)*





Environmental Quality as a Public Good:

Methods for revealing WTP from environmental economics can be applied in developing countries:

Contingent Valuation – ask people in a survey (often yes no) what value they place on a specified change from the current situation.

Hedonic Methods – value of public good is embedded in private good that does enter the market. Try to decompose price. Air quality, valuation of genetic resources in livestock and cropping systems

Travel Cost –we can recover the value people put on an environmental good by summing the explicit and opportunity costs of accessing that environmental good.

Averting Expenditure – we can recover the value of an environmental good by summing the value of expenditures people undertake in the absence of that public good.

Commons are found in various forms in developing countries.

- Forests (both the wood and the non timber forest products)
- Fisheries
- Irrigation Schemes
- Pastures

Managing the Commons:

- Institutional arrangements: Ostrom et al.

- Conflict – commons as a source of conflict, conflict preventing use of commons.

- Dynamics: Appropriation externality vs. provision externality.

We can also describe a situation where degradation occurs on private land due to poverty and market failure that can be addressed by policy measures.

A basic example is a credit market failure.

High return / less environmentally damaging strategies entail significant fixed costs.

Poorer households lack capital to undertake investments meeting these fixed costs.

They may substitute natural capital for financial capital (no fertilizer or manure or compost, so they exhaust the soil).

Title to land, land reform, credit markets…all may have an environmental aspect to consider in addition to the agricultural productivity or poverty reduction issues we have looked at before.

Note that in developing countries it may be that government is not the only source of environmental regulation.

Traditional rules and regulations are often in place in developing country societies.

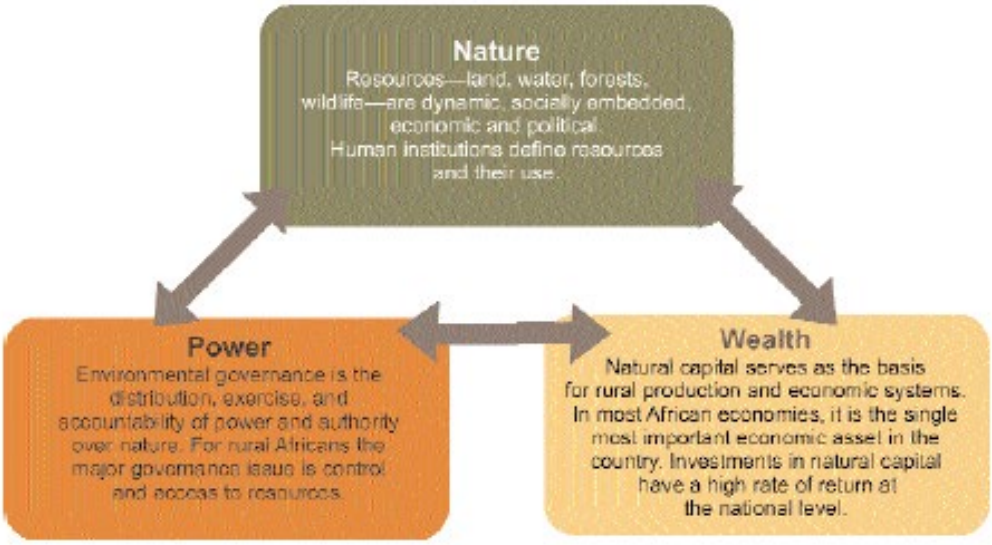
The appropriation of this role by the state can undermine the traditional, functioning system, thus making things worse.

- State control takes common property and turns into open access

However, also note that traditional systems have to adapt to new, changing circumstances. What determines success or failure here?

What is the role of community management of natural resources, and how is this to be reconciled with the functioning of a state?

Nature Wealth, and Power—Definitions and Links



Principles to Guide NRM Investments in Africa

Nature:

- Improve information and knowledge management systems
- Promote local land use planning and appropriate resource tenure systems
- Foster innovation, social learning, and adaptive management
- Build capacity and invest in human resources
- Promote cost-effective technical advisory and intermediary services

Wealth:

- Be strategic about the economics of natural resource management
- Strengthen markets and NRM market incentives
- Invest in rural organizations
- Create a framework for better NRM choices
- Assure that local resource managers have secure access to NRM means and benefits

Power:

- Strengthen environmental procedural rights for rural people
- Improve rural input into public decisions and policy
- Redistribute natural resource authority and functions
- Transfer powers, rights, and responsibilities to representative and accountable authorities
- Explore a minimum environmental standards approach
- Promote platforms that allow for continuous and inclusive consultations

Finally, consider environment and vulnerability. We can think of environment as the source of risk or uncertainty.

Economic development can suffer due to adverse environmental shocks.

Drought, flood, hurricanes, tsunamis, mudslides, earthquakes,…

Loss of life.
Humanitarian issues.
Urbanization may make it more likely a given environmental shock has a negative impact.
Population growth and where people are located may make it seem like the shocks are more common.
Asset loss in the shock may have long term consequences.

Economic development may be taking place in the context of environmental change so that accomplishments may be threatened in the future / challenges may be increasing over time.

"…a 2.5 degree C rise in average temperature could decrease the net returns to cropland by $16 billion each year in SSA" The Wealth of Nations.

In either case, there is a case to be made for improved information systems, technology development, extension, and infrastructure.

Protection of genetic resources in light of this changing system.
Improve quality of forecasts / warnings.

Improve quality of information delivery.

Develop technology and infrastructure that allow people to act on this information.

Develop extension services that present and support adoption on new technologies.