The

Glossary:

Ecological Economics from the Bottom-Up

List of CEECEC Partner Organisations

CSO Partners

- Centre for Science and Environment, India
- Centre pour l'Environnement et le Développement, Cameroon
- Acción Ecológica, Ecuador
- Ecological Society Endemit, Serbia
- A Sud - Ecologia e Cooperazione, Italy
- Vlaams Overleg Duurzame Ontwikkeling, Belgium (Flanders)
- Sunce, Association for Nature, Environment and Sustainable Development, Croatia
- Instituto Rede Brasileira Agroflorestal, Brazil

Research Partners

- ICTA, Universitat Autònoma de Barcelona, Spain (CEECEC Coordinators)
- IFF, Universität Klagenfurt, Austria
- GEPAMA, Universidad de Buenos Aires, Argentina
- Foundation of the Faculty of Sciences and Technology, New University of Lisbon, Portugal
- Université Libre de Bruxelles, Belgium
- SERI Nachhaltigkeitsforschungs und Kommunikations GmbH, Austria

How to Use this Glossary

Download and save the document to your computer in order to navigate quickly and easily between text and hyperlinks. If you are using Adobe Reader 9 go to “View” in the toolbar and select “Go to” and then “Previous view” to return to your place in the text after following a hyperlink, or use the keyboard shortcut Alt +Left Arrow

Table of Contents

Introduction

This glossary is the product of collaborative efforts between environmental activists and ecological economists from around the world, all belonging to the CEECEC network (see List of Partner Organisations). CEECEC (www.ceecec.net) is a project funded by the European Commission's Science in Society programme, running from April 2008-September 2010, under the Seventh Framework Programme (FP7). Its overarching objective is twofold: to build the capacity of civil society organisations (CSOs) to participate in and lead ecological economics research on sustainability issues for the benefit of their organisational goals, while at the same time to enrich ecological economics research with highly valuable activist knowledge.

CEECEC has taken an approach illustrative of what Andrew Stirling of SPRU (Science and Technology Policy Research), University of Sussex, has called cooperative research. This is a new form of research process which involves both researchers and non-researchers in close co-operative engagement, encompassing a full spectrum of approaches, frameworks and methods, from interdisciplinary collaboration through stakeholder negotiation to transdisciplinary deliberation and citizen participation. This is not new in practice. For instance, the first reports on the State of the Environment in India were put together in the 1980s by drawing on knowledge of both activist organizations and academics across the sub-continent. In CEECEC, CSO partners with total autonomy chose conflicts they wanted to focus on to develop into case studies. The CEECEC team at ICTA UAB, other academic partners, and other participating CSOs, further developed the case study drafts, deciding on the appropriate concepts from ecological economics to be applied or presented in those contexts. Environmental CSOs, particularly those concerned with environmental justice (we refer to these as Environmental Justice Organisations, or EJOs), frequently carry out research on environmental conflicts, writing reports as part of their advocacy work. CEECEC then provided to these EJOs a critical audience of interested activist and academic partners who asked questions, gave encouragement, made comparisons, and suggested key words and references, keeping in mind the final objective of developing a Handbook (as well as a series of lectures) useful for teaching ecological economics from the "bottom-up" instead of from first principles.

The glossary and its entries are a by-product of the CEECEC online handbook, *Ecological Economics from the Bottom-up*. It was written by CEECEC partners to complement the case study chapters in the handbook by explaining in greater depth the concepts presented within them. Glossary entries were produced by drawing upon knowledge already in the public domain (on the internet and in other publications in ecological economics and political ecology), and in some cases, on the original research of the authors. There are over 90 entries in all, covering topics in alphabetical order from Access and Use Rights to Well Being. Many of the Glossary entries are key words of the case study chapters in the handbook, but not all. The glossary, (like the handbook) may be used as a stand-alone resource for anyone from the general public, civil society or academia in search of a reference tool for the concepts and methods of ecological economics and political ecology.

1 Access and Use Rights

Definition and Purpose

Among the institutional arrangements regulating human-nature relationships, rights and obligations to natural resources, access and use rights in particular play a crucial role (Bromley, 1991; Ostrom & Schlager, 1996; Le Roy, 1996; Van Griethuysen, 2006). Such rights or rules exist in all societies, whether they are tribal, feudal, capitalist or socialist. They basically respond to the universal question of social reproduction and are obviously culture-specific and exhibit considerable diversity and variation. On the one hand, they determine the types of interactions that members of society may or may not have with the natural environment. On the other hand, they are essential factors of power and social status because of the control they confer over natural resources, and as such constitute strategic elements in the dynamics of wealth creation and reinforcement of power. Bromley (1991) uses the term *institutional regime* to refer to the set of institutional arrangements relating to a resource or a set of natural resources.

A typology of rights concerning natural resources

The typology most commonly referred to in the literature is the one proposed by Ostrom and Schlager (1996), which defines a cumulative gradation between rights:

- *Access right:* right to access a resource for any use not involving its consumption; Peluso and Ribot (2003) have defined access as the *ability* (not necessarily the *right*) to derive benefits from things;
- *Withdrawal right:* right to withdraw some elements from the resource;
- *Management right:* right to determine how, when and where a withdrawal may take place;
- *Exclusion right:* right to determine who has rights of access, withdrawal and management, and who is excluded from these rights;
- *Transfer right:* right to transfer a resource or a right over a resource to a third party.

These rights have a cumulative nature (Ostrom & Schlager 1996). For example, management rights usually include access and withdrawal rights. Generally, when agents have more rights, they have greater control over the relevant resources and have greater influence over the evolution of the institutional framework. On the other hand, those who must respect the instituted rights have less power to influence the institutional framework according to just how excluded they are from these various rights.

A typology of institutional regimes

Following Bromley (1991), four types of regimes are usually distinguished, depending on the competent authority responsible for the definition and application of resource use rights:

1. *Open access:* this defines a "non-regime" case as it refers to the absence of institutional arrangements regarding the natural environment: no right or duty is defined regarding resources and there is no recognised authority to impose sanctions. This is for instance the case of access to fisheries in the high seas in the absence of any regulation. The effects of this type of non-regime are what Hardin erroneously referred to as The Tragedy of the Commons*;*

2. *State regime:* the state has decisional authority regarding resource rights; it can thus determine who will benefit from access and withdrawal rights, who has management authority regarding resources, and it can define the methods of exclusion and transfer of the resources. This regime can also include cases where resource management is delegated to other social actors such as NGOs, private actors or local communities;

3. *Common regime:* the decisional authority for resource rights is jointly assumed by members of a community according to the model of social organization defined by that community (for instance, use of water from a river in a village, through communally owned irrigation infrastructure by communally determined allocation rules);

4. *Private property regime:* private property owners (individuals or organizations) hold property titles over resources, which assures them all rights over resources (access, withdrawal, management, exclusion and transfer). The exercise of these rights remains limited by the measures that ensure the maintenance of the institutional framework in force.

The four regimes presented above represent theoretical categories that can be used to describe characteristics of actual cases, which usually correspond to a combination of regime types. For example, a state – which international law recognises as sovereign over resources situated on its national territory – can give access, withdrawal and management rights to non-state actors (private corporations, conservation agencies, local communities). Also, private property regimes require an authority, generally the state, that is able to impose respect for property rights by non-owners. Thus, each level of rights can correspond to sub-regimes, which in turn can correspond to specific institutional arrangements.

References

Bromley, D.W., 1991, *Environment and economy – property rights and public policy*. Oxford: Blackwell.

Ostrom, E., and E. Schlager, 1996. The formation of property rights. In: S. Hanna *et al.* (eds.), *Rights to nature: ecological, cultural and political principles of institutions for the environment*, pp. 127-156. Washington, D.C.: Island Press.

Peluso, N., and J.C. Ribot, 2003. A theory of access. *Rural Sociology*, 68(2): 153-181.

Van Griethuysen, P., 2006. A critical evolutionary economic perspective of socially responsible conservation. In: G. Oviedo, P. Van Griethuysen and P. Larsen (eds.), *Poverty, equity and rights in conservation*. Gland: IUCN; Geneva: IUED.

2. Activist Knowledge

Definition

Activist knowledge refers to all kinds of experience-based knowledge originating from activists in a broad sense, including community groups, NGOs, women's groups, trade unions, grassroots associations and so on. It is generally opposed to "official" sources of knowledge stemming from academic, private sector or governmental research organizations. It is based on the fact that activists tend to develop their own independent knowledge about situations they are concerned with, a process which may result in radically different conclusions than "official" knowledge. As explained by the post-normal science perspective of Funtowicz and Ravetz (1994), in many current socio-environmental problems of importance and urgency, where values are in dispute and uncertainties are high, "certified" experts are frequently challenged by citizens' groups. Strand and Cañellas-Boltà (2006), point out that the unprivileged may actually perceive aspects of a given socio-environmental phenomenon more clearly than the well-off as they are more directly impacted by it. The Love Canal case is an example of this.

An illustration: The Love Canal

The Love Canal is a working-class neighbourhood in the suburb of Niagara Falls (New York State). During the 1970s, the neighbourhood suffered from unusually high rates of sicknesses (miscarriages, birth defects, cancers). Lois Gibbs, one of its residents, started in 1978 to investigate the incidence of diseases in her community and the possible relationship to the 20 000 tonnes of toxic waste that had been disposed of in the canal by the Hooker Chemical Company during the previous twenty years. Her own observations led her to put forward a causal relationship between health problems and the toxic waste dump. The state authorities – together with Occidental Petroleum (which had bought Hooker Chemical) – refused to acknowledge the connection. Even university experts disregarded Gibbs' conclusions.

Figure 1 : Image from http://www.damninteresting.com/the-tragedy-of-the-love-canal

She and her group (mostly composed of women) struggled for more than two years for relocation. “It was not until women had vandalized a construction site, burned an effigy of the mayor and been arrested in a blockade that government officials began to take notice” (Mellor, 1997: 21). Finally, in 1980, President Carter delivered an Emergency Declaration which moved 900 families from the hazardous area. Gibbs’s experience at Love Canal led to her setting up in 1981 a national network, the “Center for Health, Environment and Justice”, an organisation that has assisted more than 8000 grassroots groups with organisational, technical and general information nationwide. This environmental justice movement can be seen as an example of the “Environmentalism of the Poor”. It is also an emblematic movement of ecofeminism, as women – due to the traditional sexual division of work keeping them outside of ‘official knowledge’ – are often key developers of activist knowledge.

A note on the status of activist knowledge

Although activist knowledge continues to be regarded with suspicion by many scientists, the use of civil society investigations and publications in political ecology, ecological economics and gender studies is hardly new (Rocheleau *et al.*, 1996; Paulson *et al.*, 2003). Anthropologist Arturo Escobar (2008) is one of the most well-known students of “local activist knowledge”. Some academic programs invite knowledgeable activists as speakers or visiting fellows, for instance James Scott’s agrarian program at Yale University, and David Harvey’s geography program at City University of New York. Promotion of activist knowledge represents one of the main objectives of CEECEC. Activist knowledge can indeed be crucial for social sciences,

yet it is not mechanically true that research growing out of a community of poor or oppressed people by itself will bring deeper insights than a study carried out by, say, government.

References

Escobar, A., 2008. *Territories of difference: place, movements, life, redes*. Durham: Duke University Press.

Funtowicz, S., Ravetz, J., 1994. The worth of a songbird: ecological economics as a post-normal science. *Ecological Economics*, 10: 189-196.

Mellor, M., 1997. *Feminism and ecology*. New York: New York University Press.

Paulson, S., Gezon, L.L., Watts, M., 2003. Locating the political in political ecology. *Human Organization*, 62(3): 205-217.

Rocheleau, D., Thomas-Slayter, B., Wangari, E. (eds.), 1996. *Feminist political ecology*. London: Routledge.

Strand, R., Cañellas-Boltà, S., 2006. Reflexivity and modesty in the application of complexity theory. In: *Interfaces between science and society*, eds. Â. Guimarães Pereira, S. Guedes Vaz, S. Tognetti, pp. 94-111. Sheffield: Greenleaf.

3. Affluence and Environmental Impact

Definition and Measurement

Affluence relates to the average consumption of each person in the population. A common proxy for measuring consumption is through GDP per capita. While GDP per capita measures production, it is often assumed that consumption increases when production increases. GDP per capita has been growing steadily over the last few centuries and according to the formula *I=PAT*, called the *impact equation*, is driving up human impacts on the environment.

The equation *I=PAT* was proposed and developed by Ehrlich, Holdren and Commoner in the early 1970s (Ehrlich and Holdren 1971, Commoner 1972, Holdren and Ehrlich 1974). It recognizes that the impact of a human population on the environment can be thought of as the product of the population's size (P), its affluence (A), and the environmental damage inflicted by the technologies used to supply each unit of consumption (T). Sometimes, because of the difficulty in estimating A and T, per capita energy use is employed as a surrogate for their product. Some equate T with impact per unit of economic activity (Dietz and Rosa 1994), and for others T is a rather fuzzy category covering all sources of variation apart from population and affluence (Fischer–Kowalski and Amann 2001).

Alternatives to I=PAT

While the I=PAT equation quickly became established as the norm and has been used and cited by many organisations and individual people ever since, recently, various alternative formulations of the equation have been proposed:

Dietz and Rosa (1994) gave a stochastic (probabilistic) reformulation of the impact equation (STIRPAT – Stochastic Impacts by Regression on Population, Affluence and Technology) which they claimed facilitates the application of social research statistical tools to studies on I=PAT. Their formulation is I = aP b A c T d e. They define A and T as per capita economic activity and the impact per unit of economic activity respectively; a, b, c, and d are parameters and e, a residual term.

Schulze (2002) proposed modifying the formula to I=PBAT, which calls attention "to the many behavioural choices that are immediately available to all individuals". Schulz points out that affluence and technology do not dictate behavioural decisions. He gives the example of a person who is wealthy and only uses the most efficient devices, and whose environmental impact will still depend on whether or not the person is a profligate consumer.

Willey (2000) noted that consumption is influenced by lifestyle and organisation - improved organisation in rich countries could lead to a reduced per capita consumption, but in poor countries better organisation might lead to a huge increase in consumption. So he proposed changing the impact equation to I = PLOT (population, lifestyle, organisation, technology).

Another tool that has been used to observe the impact of affluence on the environment is the Environmental Kuznets Curve (EKC). This is used to model the interrelation between affluence (measured in per capita GDP) and environmental impacts (in terms of physical amounts per capita), while keeping population numbers constant. Technology understood as including all sources of variation apart from population and affluence, shows up as (random) deviation from the 3rd order polynomial function. The environmental Kuznets curve (EKC) hypothesis states (arousing much controversy) that the environment is initially exploited to a great extent in order to create economic growth but when an economy becomes developed enough, the environment becomes more valued, and technical progress makes it possible to create wealth with less environmental stress. Therefore as countries become more wealthy environmental stress will begin to decline at a certain income level. This might be true for some pollutants (such as sulphur dioxide) but it is not true for carbon dioxide emissions, domestic waste, and other variables.

Recent Findings

Fischer–Kowalski and Amann (2001) studied the complexity of the Affluence – Impact relationship, referring to studies on Material Flow Analysis (MFA). At the centre of such studies was the belief that impact need not necessarily grow proportionately to affluence. Therefore, it should be possible to achieve some

measure of delinking (or decoupling) of material input and output (impact), and economic activity measured by GDP (a measure of affluence). Delinking came to be subdivided into two categories – relative delinking and absolute delinking. If there was a reduction in environmental impact per unit of GDP, it is termed relative delinking. If on the other hand economic growth continues but the absolute amount of materials used declined, it is termed absolute delinking.

Fischer–Kowalski and Amann argue that the full understanding of the impact equation must take into account the variety of socio-economic systems in different countries and the effects of globalization and trade: "All socio-economic systems for which the I=PAT question may be posed are embedded not only in natural environments but also in networks of social systems with which they interact. The very nature of this interaction seems to be of crucial importance for their environmental (and of course also their economic) performance, and this is even more so in the face of globalization".

References

Commoner, B. (1972): The closing circle. Jonathan Cape , London

Dietz, T. and Rosa, E.A. (1994): Rethinking the environmental impacts of Population, Affluence and Technology. Human Ecology Review. Summer/Autumn, 1.

Ehrlich, P.R. and Holdren, J. P. (1971): Impact of population growth. Science 171: 1212-1217.

Fischer–Kowalski, M and Amann, C. (2001): Beyond IPAT and Kuznets curves: Globalisation as a vital factor in analysing the environmental impact of socio–economic metabolism. Population and Environment 23, 1: 7–47

Gaia Watch of the UK: I=PAT. An Introduction [Online]: URL: http://www.population-growth-migration.info/essays/IPAT.html [Last modified August 26, 2009; Retrieved: October 15, 2009].

Gaia Watch of the UK: Population and Growth Migration *(*http://www.population-growth-migration.info/*)*

Holdren, J. P. and Ehrlich, P.R. (1974): Human population and the global environment. *American Scientist* 62, 3: 282-292.

Schulze, P. C. (2002). I=PAT . *Ecological Economics* 40; 149-150.

Willey, D. (2000). Some hopes and thoughts for the future. Optimum population Trust, Manchester.

Websites:

http://stirpat.org.

4. Avoided Deforestation (REDD+)

Programs to Reduce Emissions from Deforestation and Forest Degradation in developing countries

This glossary note refers to the emerging REDD+ arrangements (actions to reduce emissions from deforestation and forest degradation, plus other ways to enhance or otherwise maintain carbon in the terrestrial landscape) of the post-2012 global climate accords. Deforestation and associated land use changes generate on the order of 17-20% of all greenhouse gas (GHG) emissions globally each year, primarily in the form of CO_2 (IPCC, 2007).

Deforestation Hotspots

In some countries such as Brazil and Indonesia, deforestation constitutes the single most important share of national emissions (averaging 54% in Brazil and 44% in Indonesia over the 2000-2005 period according to estimates based on FAO and WRI data). These two countries alone were responsible for an estimated 60.6% of all deforestation in the humid tropics between 2000 and 2005 (Hansen et al., 2008). If deforestation could be substantially reduced in just these two countries it would make an enormous contribution to overall efforts to reduce global emissions. Other countries, such as the Democratic Republic of Congo, also experience serious deforestation contributing to global emissions; but their governance conditions are more precarious (Angelsen, 2009).

The Limitations of Global Climate Accords

The Kyoto Protocol of 1997 signed by parties to the United Nations Framework Convention on Climate Change (UNFCCC) required that only those nations included in its Annex I (high per capita income nations) set targets for emissions reductions. Thus there are no current formal and legally binding limitations set on tropical deforestation even where this constitutes significant shares of national and indeed global emissions. There is no other global mechanism to restrain nations from expanding agricultural and resource extractive frontiers into areas of intact tropical forest.

Despite the failure of the meeting in Copenhagen in December 2009, a post-Kyoto agreement requires adoption of emissions reductions targets by most signatories of the UNFCCC. There are a number of reasons that efforts to reduce deforestation have been addressed as a separate issue within the post-2012 negotiations:

1) Fears on the part of parties engaged in emissions trading that REDD credits would flood the nascent carbon market (see Carbon Trade), undermining the value of Certified Emissions Reductions (CERs) issued by the Clean Development Mechanism (CDM) under the rules of the Kyoto Protocol, and hence undermining CDM related incentives to invest in GHG emissions controls over fossil fuels and associated industrial sources. The overall carbon market could thereby be irreparably weakened as a source of finance for environmental investment. However,

REDD would have only a low impact on overall carbon prices provided the emissions reductions commitments assumed by industrial nations are strong enough;

2) Perceptions that additional forest-related emissions reductions would be only temporary in duration, since at some point forests would die off or cease being net absorbers of carbon. Indeed, the possibility of Amazon forests reverting their absorption of CO2 has been backed up by scientific research over many years. The hypothesis is that with global warming, temperature increase above a certain level will result in negative CO_2 balance by forests. (It is currently positive, i.e., there is net photosynthetic sequestration even in forests that are at ecological climax).

3) Leakage of activities such as ranching or crop or tree plantation production. So, you preserve a forest under a REDD scheme and you move to deforest another area. If this occurs internationally it is even more difficult to control, due to the absence of a global authority or agreement to oversee such displacement. By some accounts 80% of leakage would occur beyond the borders of the country from where deforestation is displaced.

4) Concerns of voluntary investors outside compliance based (European Emissions Trading Scheme and CDM) markets who favour devoting resources to reducing deforestation for ecological or cultural co-benefits (such as biodiversity conservation, environmental services such as water resource provision or pollination, or preservation of sacred groves important to indigenous groups, etc....) or social equity effects that are difficult to value.

Other Concerns

Equity concerns have been central to the discussion of REDD, and is one of the reasons that those who support a broader scope (ie., REDD+ and even REDD++, which would include agricultural activity) have been able to obtain greater support in the most recent climate discussions. The fact that much deforestation, particularly in Latin America, is due to agribusiness expansion into the Amazon basin rather than smallholder's shifting agricultural activities, has led to accusations that REDD might just be another way to bail out the large farmer. But the equity matters in REDD are very similar if not superimposed on an already fertile discussion within the realm of Payments for Environmental Services.

A nation state approach to REDD would conceivably permit intra-national leakage to be internalized by the agreement. After all, nation states are the parties to the agreement and must demonstrate progress toward targets, with adequate intelligence regarding the rate of change in land use against adopted baselines (levels of deforestation against which future land use change is compared based on historical land use change or future anticipated demands for forestland conversion). But national capacity to adjust the rate of land use change to meet planned targets is poor at best, not least due to the fact that much deforestation is due to exogenous pressures (Combes et al., 2008) such as incentives for agrofuels expansion in

pasture areas far from the forest, but which motivate ranchers to move their cattle out to the frontier.

While good estimates abound of the potential cost of private compensation necessary to offset greenhouse gas emissions generated from forest clearing (opportunity costs + transaction costs), estimates of implementation costs for REDD on the part of national authorities are not readily available (in the Amazon, for example, costs of such additional governance effort is estimated on the order of $300 million/yr; Nepstad et al., 2007). Such costs are at present embedded in monitoring and repressive actions for enforcing existing forest codes, and as budgetary increments on their own are unlikely to be sufficient, meeting them will require compensatory payments and/or other programmatic incentives to motivate landowners to adopt better production practices.

The Way Forward?

Reviews of alternative REDD architectures (e.g., GCP, 2008) suggest that a mixed approach, involving nation state demonstration of progress toward GHG reduction targets combined with voluntary project activities would be most effective in achieving objectives. Alternative carbon accounting architectures, some of which have been described in the literature cited, and in national and institutional submissions to the UNFCCC include:

1) national carbon accounting based on macro land use monitoring, excluding project level activities, to avoid double counting when aggregating reductions;

2) parallel but separate accounting for projects and nation-states, enabling parties to tax carbon credits secured by projects in voluntary markets (thus requiring disclosure of private investments in these markets, but allowing that financing flows bypass the national authority), deducting project reductions from overall national reductions to avoid double counting;

3) nation-state accounts validating all project and non-project emissions reductions, requiring the creation of a national registry of project activities and accomplishments, and infrastructure for monitoring and validation. In this case control over financing flows could be parallel but accounting would be centralized.

The complexities of these alternatives and their imaginable variants, have led to a state of indecision regarding initiation of activities along these lines, though the desirability of actions to reduce deforestation was endorsed at COP15 in Copenhagen in December 2009 (SBSTA, 2009). This process is clearly unfolding.

References:

Angelsen, A. (ed.) *Realising REDD+; national strategy and policy options*. Copenhagen: CIFOR, 2009. Available for download at: http://www.cifor.cgiar.org/publications/pdf_files/Books/BAngelsen0902.pdf.

Combes Motel, P., Pirard, R., Combes, J.L. A methodology to estimate impacts of domestic policies on deforestation: compensated successful efforts for “avoided deforestation” (REDD). *Ecological Economics* 68 (3), 680–691, 2008.

Food and Agriculture Organization. *State of the World’s Forests, 2009*. Rome, 2009.

Global Canopy Project (GCP). *The Little REDD Book*. Oxford, UK, 2008.

Hansen, C. et al. Humid tropical forest clearing from 2000 to 2005 quantified by using multitemporal and multiresolution remotely sensed data. *PNAS* 105 (27): 9439–9444, 2008.

Nepstad, D. et al. *The costs and benefits of reducing carbon emissions from deforestation and forest degradation in the Brazilian Amazon*. Woods Hole Research Center, 2007.

Subsidiary Body for Scientific and Technological Advice (SBSTA). Reducing emissions from deforestation in developing countries: approaches to stimulate action. Agenda item 5, 31st session, Copenhagen, 8–12 December 2009. FCCC/SBSTA/2009/L.19/Add.1, 11 December 2009.

World Resources Institute (WRI). *Climate Analysis Indicators Tool (CAIT)*. Available at http://cait.wri.org/cait.php.

5. Bulk Commodities and Preciosities

Concept Origins

The increased use of energy and materials in the world economy means that many remote areas around the world have become extractive frontiers from where “bulk commodities” essential to the metabolism of the rich economies (oil, coal, gas, iron ore, bauxite, copper, timber, hydroelectricity) or “preciosities” (diamonds, gold, mahogany, aquaculture shrimp) are supplied. The distinction in world systems theory between trade in “preciosities” *versus* trade in “bulk commodities” has been proposed by Wallerstein (1989).

Bulk commodities such as oil or copper are products that are relatively inexpensive per kilogram and that usually have serious environmental impacts during the extraction process. Preciosities on the other hand, have a high chrematistic value per kilogram, and are non-essential for the metabolism of the importing countries or regions, but they may also have large-scale environmental impacts on ecosystems and human livelihoods, as with gold mining (which implies an enormous ecological rucksacks for opencast mining) or shrimp farming (a large industry that has grown in the tropics at the expense of mangroves and human livelihoods) or ivory extraction that has killed so many elephants.

Early bulk commodities (such as guano, wood, cotton, and sugar) played a substantial role in the metabolism of importing countries in the 19th century. In contrast, the local ecological impacts of precious exports of ivory or tiger body parts are great compared to the irrelevance of such trade for the importing countries' social metabolism. In the 19th and early 20th centuries, the countries of today's European Union depended on their own coal and biomass as energy sources. Now they have become large net importers of oil and gas, and may well resort to large-scale agrofuels imports from Brazil, Argentina, Peru, Colombia, Canada. Taking all materials together (energy carriers, minerals, metals, biomass), the European Union (15 countries) imported about four times more than it exported in the year 2000. Meanwhile, Latin America exported six times more than it imported. This almost certainly means heavy environmental impacts in the extractive regions, along with local resistance from communities whose livelihoods are threatened.

Difficulties and refinement

World systems theory has traced a contested distinction between essential "bulk commodities" and "preciosities". Anthropologists, for instance, object to the view that exchanges of preciosities, as distinct from trade in bulk, are not essential to the constitution of world systems. They argue that pure "prestige goods", far from being superfluous, are on the contrary crucial in a social sense (as dowry for instance, or for the accumulation of political power in clientelistic systems).

At the beginning of European colonization, all imported goods were preciosities, for instance silver and pepper. The means of transport at the time made bulky trade impossible. Interestingly, some preciosities have changed status and become staples. Sugar for instance (as Sidney Mintz showed) was a luxury good. But later, as a result of the slave plantations, it became a source of cheap calories, that is, a bulk commodity playing an important role in the bio-metabolism (endosomatic energy) of the English working class. However, some preciosities remain true preciosities, such as diamonds and gold. They are not essential inputs to production processes and they have not become cheap wage-goods. They are genuine luxury goods – even though in the extractive region they destroy human health and the environment, as was the case with the use of mercury in silver mining in Potosi (today's Bolivia) in colonial times.

References

Martinez-Alier, J., 2007. Marxism, social metabolism, and international trade. In: A. Hornborg, J.R. McNeill and J. Martinez-Alier (eds.), *Rethinking environmental history: world-system history and global environmental change*. Lanham: AltaMira Press.

Martinez-Alier, J., 2009. Social metabolism, ecological distribution conflicts, and languages of valuation. *Capitalism Nature Socialism*, 20(1): 58-87.

Wallerstein, I., 1989. *The modern world-system. The second great expansion of the capitalist world-economy, 1730-1840*, Vol. III. San Diego: Academic Press.

6. Carbon Trade

Basic rationale

Launched through the Kyoto protocol in 1997, carbon trading is an approach to controlling pollution by providing economic incentives for reduced emissions of atmospheric carbon dioxide. Carbon trading takes two main forms: “cap and trade” and “offsetting”. With cap and trade schemes, governments or intergovernmental bodies set an overall legal limit on emissions in a certain time period (a “cap”) and then grant industries a certain number of licenses to pollute (“carbon permits” or “emissions allowances”). Companies that do not meet their cap can buy permits from others that have a surplus (hence the “trade”). The cap is supposed to reduce emissions over time. The goal of the system is to help polluters meet “reduction” targets in the cheapest way possible. Often linked with carbon offsetting schemes, or “emissions-saving projects” such as building hydro-electric dams, the ‘cap and trade’ concept was created to compensate for continued pollution in industrialised countries in the North. While southern movement and some governments ask for repayment of the Ecological Debt (including the “carbon debt”), Northern governments offer at most “cap and trade” schemes, including the CDM and REDD.

Limits and controversies

Carbon trading does not actually reduce emissions, but gives companies greater room to manoeuvre in addressing the emissions problem (hence the name “flexible mechanism”). Companies exceeding their reduction commitments can sell their surpluses to those who have failed to clean up their activities adequately. Companies that want to keep on polluting save money, while in theory companies that are able to reduce beyond legal requirements will seize the chance to make money from selling their spare credits. But this flexibility comes at a cost – what is cheap in the short term is not the same as what is effective in the long term or environmentally and socially just. The number of permits awarded is usually calculated according to existing levels of pollution (say, with a 10 or 20 per cent reduction), which means that those who have polluted most in the past are rewarded with the greatest subsidy. This is usually called “grandfathering”. Hence the observation that “this free gift of pollution rights to some of the worst industrial polluters amounts to one of the largest projects for the creation and regressive distribution of property rights in history” (Gilbertson and Reyes, 2009). At world level, this is what happened in Kyoto in 1997: Annex I countries promised (if anything) a slight reduction of emissions compared to 1990, and they got in exchange a right to occupy the carbon sinks and the atmosphere. Moreover, they insisted in not doing internally the promised reductions but they wanted to use in part the CDM.

The UN-administered Clean Development Mechanism (CDM) is the largest carbon offsetting scheme, with almost 1,800 registered projects as of September 2009, and over 2,600 further projects awaiting approval. Based on current prices, the credits produced by approved schemes could generate over US$ 55 billion by 2012. Although offsets are often presented as emissions reductions, they do not reduce emissions at source, but move “reductions” to where it is cheapest to make them, which normally means a shift from Northern to Southern countries. Pollution continues at one location on the assumption that an equivalent emissions saving will happen elsewhere. The carbon “savings” are calculated according to how much less greenhouse gas is presumed to be entering the atmosphere than would have been the case in the absence of the project. But even World Bank officials, accounting firms, financial analysts, brokers and carbon consultants involved in devising these projects often admit privately that it is difficult to count the actual amount of carbon dioxide saved.

The difficulty is this: “Offsets are an imaginary commodity created by deducting what you hope happens from what you guess would have happened” (Welch, 2007). Since carbon offsets replace a requirement to verify emissions reductions in one location with a set of stories about what would have happened in an imagined future elsewhere, the net result may well be an increase in greenhouse gas emissions!

Carbon offset projects have resulted in land grabs and the repression of local communities. Voluntary offsets, which give consumers in the global North a means to make a payment to assuage their guilt about consumption, and companies the chance to present a green face to the public, run into similar problems. Offsets on the voluntary market exist outside UN regulation, but they have sometimes similarly negative consequences on the communities forced to endure them. Gilbertson and Reyes (2009) add that “these personal offsets individualise the response to climate change, distilling the complexities of a systemic problem of how energy is produced and used, and how land is distributed, into a seemingly simple question of authorising a small payment with the click of a computer mouse”.

References

Gilbertson, T. and Reyes, O., 2009. Carbon Trading: how it works and why it fails. *Critical Currents*, 7. November 2009.

Lohmann, L., 2001. Democracy or carbocracy? Corner House Briefing Papers No. 24. The Corner House, Sturminster Newton.

Welch, Dan, quoted by Nick Davies, *The inconvenient truth about the carbon offset industry*, The Guardian, June 16, 2007

7. Carrying Capacity

Definition

This is a term used in the field of ecology to indicate the maximum population of a particular species that a given area of habitat can support over a given period of time without destroying or hampering the resource base.

Calculation

The population of any species (including humans) in a territory may increase in different patterns. It may increase exponentially for a while, i.e. in geometric progression from 1, 2, 4, 8, 16 etc..., sometimes referred to as Malthus' law of population growth. Or, more realistically, it may increase according to Verhulst's law (1838), representing a logistic curve. Population is represented in the vertical axis, and time in the horizontal axis whereby maximum population "k" is determined by the carrying capacity of a territory (**Figure 1**).

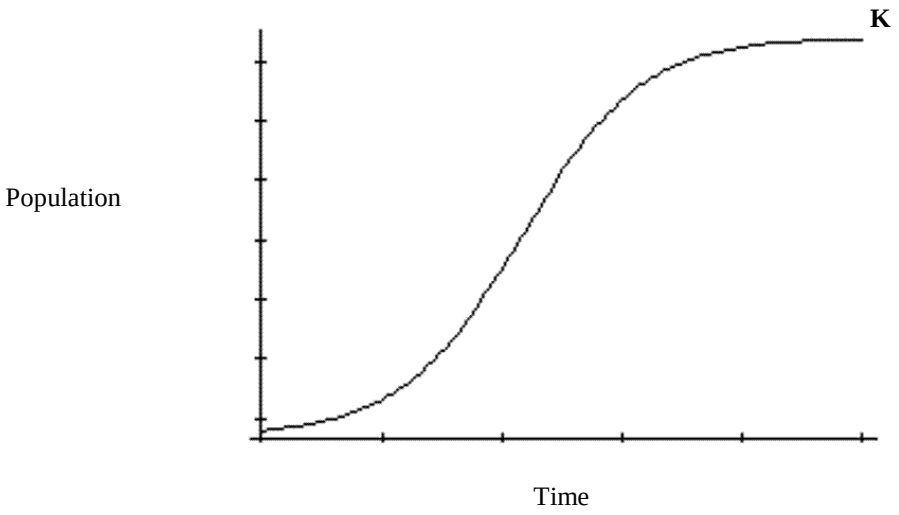


Figure 1: Maximum population according to Verhulst's law

Application

Factors that affect the impacts / pressures of different animal species on a given tract of land and its resources include**:** disease / parasites; starvation; predators; pollution; accidents; old age; hunting; development by humans that results in loss of habitat. Applied to the human species, we can say of a given territory (the Netherlands, for instance) that with its population density of 400 people per km^2 it has exceeded its carrying capacity because there is no way in which this country could sustainably support its population at its current standard of living, directly from the resources in its own territory.

Factors affecting carrying capacity

Carrying capacity can be affected by factors such as technological advances, by trade, and by exosomatic use of energy (fossil fuels). Changes in technology change the carrying capacity of a territory as irrigation and fertilization in agriculture for example, or shorter rotations between crops increase the number of people who can be fed from the resoures of a given territory. Trade among territories increases an area's carrying capacity as elements in short supply locally are imported. In contrast, as availability of fossil fuels decreases with peak oil, the carrying capacity of many territories for humans will decrease.

8. Coasian Bargaining

Origins and Proposition

Coasian bargaining is based on the theorem developed in 1960 by Ronald H. Coase who earned the 1991 Nobel Prize in economics "for his discovery and clarification of the significance of transaction costs and property rights for the institutional structure and functioning of the economy". In his article, *The Problem of Social Cost* (1960), he proposes that well-defined property rights can overcome the problems of externalities because many environmental problems arise from poorly defined / lack of property rights. Assuming that property rights are held by the polluter and that transaction costs are zero, the Coase Theorem states that a polluter and a victim can reach a mutually beneficial bargain if the damage from pollution is higher than the polluter's net return from the sale of the good generating the pollution. In this case, a payment from the affected party to the polluter would reduce the pollution.

Thus, the Coase theorem states that the most efficient solution to resolving interdependent uses of the environment, including pollution cases, is a bargaining process among relevant property holders. If the property rights are given to polluters, victims can pay them not to pollute, creating a market-like solution; alternatively, if property rights are given to the victims, the polluters may compensate the victim or buy the right to pollute. Thus the cost of the negotiated outcome is shared between the parties without any external intervention. If transaction costs are minimal, the resulting allocation of resources will be efficient (that is, the resource will be dedicated to its highest valued use) regardless of the initial allocation of property rights. The creation of a market in the Coase solution internalizes externalities, however it does not necessarily bring pollution to a zero-level.

Application

As an example, consider the case of a railroad that passes through wheat fields. The passing trains generate sparks which can burn the wheat. If the legal rights are owned by the farmers, they can require the trains to buy spark catchers to eliminate these fires. However, if that is expensive (that is more than the value of the burned wheat), the train owners may just pay the farmers for the damage done to the crops. If the legal rights are with the train owners, the farmers may just put up with burned

crops or (if that is expensive) they can pay the trains to put on spark catchers. In both situations, the socially efficient outcome happens (install spark catchers or burn crops) and the legal rights determine who has to pay.

Another example would be that of a chemicals factory. If the initial legal framework gives people the right to breathe clean air, they could make the factory produce less or nothing at all. However, assume that the factory is willing to pay up to $5 per unit for the right to pollute enough to produce its output. If this amount is considered of greater value than that of clean air, people will take the money and put up with (the economically optimal level of) pollution. On the other hand, if the right to pollute lies with firms, people can bribe firms to pollute less.

The Coasian bargaining approach is an attractive one to some: an economy may be able to achieve Pareto-efficient resource allocation (that is no individuals can be made better off without making someone else worse off) without pervasive government regulation, and society's equity objectives can be separately achieved through the initial allocation of rights to the resource. If victims hold the rights they can market them as they want. Moreover, Coasian bargaining solutions can be particularly interesting for international externalities since there is no supranational environmental protection agency with the necessary authority to impose abatement directives or pollution taxes.

Limits

However, the number of situations for which Coasian bargaining is feasible and desirable is limited. First, Coasian bargaining doesn't eliminate the role of government in assigning initial property rights. This process will be subject to special interest group lobbying and rent seeking. Also, because many environmental externalities are indirect, cumulative, and uncertain and because resorting to the legal system involves inefficiency, the costs of enforcing or striking a Coasian bargain may be large. And, as many externalities are intertemporal, future generations are simply not present to bargain. In this case, a Coasian bargain between private parties for managing externalities cannot take place. In this case government may then become a defender of absent parties.

Anotherlimit to Coasian markets comes from the fact that many environmental externalities, like car emissions or noise in the vicinity of airports, or global effects such as climate change and ozone layer destruction, involve a large number of people. The transaction costs (of aggregating the interests of all the affected parties, hiring lawyers, negotiating an optimal abatement level, and enforcing a market agreement) will then prevent a private bargain even with a clear allocation of rights. Moreover, individuals will be tempted to act as free-riders in negotiations, undermining the negotiations themselves. Individuals would treat the outcome of negotiations as beyond their control and therefore be unwilling to bear any transaction costs (Baumol and Oates 1988). Thus, when externalities take place in

future, or when transaction costs are important and when the number of participants is large, Coasian solutions to environmental externalities must be ruled out.

References

R. H. Coase, 1960, “The Problem of Social Cost”, *Journal of Law and Economics* 3 (1): 1-44

Baumol and Oates, 1988, *The Theory of Environmental Policy*, Cambridge University Press, Cambridge, UK

Websites

http://www.coase.org/workingpapers/

http://faculty.wcas.northwestern.edu/~mwitte/pf/handouts/coase.html

9. Co-Management and Nature Conservation

Background

Many traditional societies formed – and still form – relatively closed systems in which natural resources are managed through complex interplays of reciprocities and solidarities. Dialogue and discussion among interested parties – what could be referred to as “co-management” – are still practiced in some of these societies. Forms of collective possession and local knowledge are crucial elements in the cohesion and sustainability of traditional systems. The historical emergence of colonial powers and nation states, and their imposed authority over most common lands and natural resources, led to the demise of traditional resource management systems virtually everywhere. Capitalist expansion weakened local systems, including those of customary rights, together with the domination of modern, expert-based, “scientific” practices. Conflicts and mistrust between local communities and the state became widespread. Community-based management was largely substituted by practices imposed through state laws (e.g. land nationalization) or external actors. Following this situation, Borrini-Feyerabend *et al.* (2000) write that “Whether honest dialogue and straightforward confrontation are the best strategy to protect the interests of the less privileged groups can be assessed only within specific contexts”.

Some such groups opt for all-out confrontation with little to no space for compromise. This is the choice of some indigenous groups fighting for the basic recognition of their ancestral rights. Others attempt to find a place at the negotiation table with more powerful actors (business, the government) and encounter all sorts of obstacles and difficulties. In some cases, all groups and individuals with interests and concerns about a given territory, area or set of resources understand that co-operation is necessary for effective and efficient natural resource management, and

agree to pursue that cooperation in the interest of everyone. This latter attitude may not yet be the most common, but it is spreading. It corresponds to what is referred to as “co-management.

Constitutive elements

According to the leading conservationist Borrini-Feyerabend and her team (2000), co-management of natural resources refers to:

- a pluralist approach to managing resources, incorporating a variety of partners in a variety of roles, to the end goals of sustainable and equitable sharing of resource-related benefits and responsibilities;
- a political and cultural process: seeking social justice and “democracy” in the management of natural resources;
- a process that needs some basic conditions to develop, among which are: (1) full access to information on relevant issues and options, (2) freedom and capacity to organize, (3) freedom to express needs and concerns, (4) a non-discriminatory social environment, (5) the will of partners to negotiate, and (6) confidence in the respect of agreements.
- a complex, often lengthy and sometimes confused process, involving frequent changes, surprises, sometimes contradictory information, and the need to retrace one’s own steps;
- the expression of a mature society, which understands that there is no “unique and objective” solution for managing natural resources but, rather, a multiplicity of different options which are compatible with both indigenous knowledge and scientific evidence and capable of meeting the needs of conservation and development.

9.1 Joint Forest Management

Originating in the early 1970s, the related concept of Joint Forest Management (JFM) is the official and popular term in India and elsewhere for partnerships in forest management involving both the state forest departments and local communities. Although schemes vary from state to state, the system works with villagers agreeing to assist in the safeguarding of forest resources through protection from fire, grazing, and illegal harvesting in exchange for non-timber forest products and a share of the revenue from the sale of timber products. It was born in response to the many conflicts over forests, notably the Chipko movement of the 1970s in the Himalayas (Guha, 2009).

The primary objective of JFM is to ensure sustainable use of forests to meet local needs equitably while ensuring environmental sustainability. The central premise is that local women and men who are dependent on forests at the village level have the greatest stake in sustainable forest management. The official ground for JFM was prepared by the Indian National Forest Policy of 1988 which envisaged people’s involvement in meeting their basic forest related needs and in managing their local resources. While a valuable initiative, Bina Agarwal has pointed to the “participatory exclusion” of some groups on grounds of gender or caste.

References

Borrini-Feyerabend, G., Farvar, M.T., Nguinguiri, J.C. and Ndangang, V.A., 2000. Co-management of natural resources: organising, negotiating and learning-by-doing. Heidelberg: GTZ and IUCN, Kasparek Verlag.

Guha, R., 2009. The unquiet woods: ecological change and peasant resistance in the Himalaya. Expanded Edition. Delhi: Permanent Black.

10. Commodity Chains

Background and definition

The concept of *commodity chains* was introduced by Terence Hopkins and Immanuel Wallerstein in an analysis of trade and capital flows in the global economy prior to 1800, defining it as a "a network of labor and production processes whose end result is a finished commodity" (Hopkins and Wallerstein 1986: 159). Since then different methodologies have been developed to analyze commodity chains:

Value Chain Analysis

A *value chain* describes the activities that take place in a business and relates them to an analysis of the competitive strength of the business. *Value Chain Analysis* is used to identify which activities are best undertaken by a business and which are best provided by others, or outsourced. The *value chain* describes the full range of activities required to bring a product or service from its conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use. Production *per se* is only one of a number of value-added links. There are ranges of activities within each link of the chain. Although often depicted as a vertical chain, intra-chain linkages are most often of a two-way nature – for example, specialized design agencies not only influence the nature of the production process and marketing, but are in turn influenced by the constraints in downstream links in the chain (Tallec and Bockl, 2005).

Global Commodity Chain (GCC) Analysis

The primary focus of the Global Commodity Chain (GCC) is analysis of the international trading system and the increasing economic integration of international production and marketing chains. Introduced by Gereffi during the mid-1990s, the GCC concept was developed within an analytic framework of the political economy of development and underdevelopment, originally derived from world systems' theory and dependency theory. It was developed primarily to analyze the impact of globalization on industrial commodity chains.

GCC highlights power relations, which are embedded in value chain analyses. It has shown that many chains are characterized by a dominant party (or sometimes

parties) that determine the overall character of the chain, and as lead firms become responsible for upgrading activities within individual links and coordinating interaction between the links. Here there is a distinction between two types of governance: those cases where the coordination is undertaken by buyers ('buyer-driven commodity chains') and, those in which producers play the key role ('producer-driven commodity chains') (Tallec and Bockl, 2005). The relatively capital-intensive manufacture of automobiles, aircraft and electrical machinery can be thought of as examples of producer-driven commodity chains.

"Approche Filière"

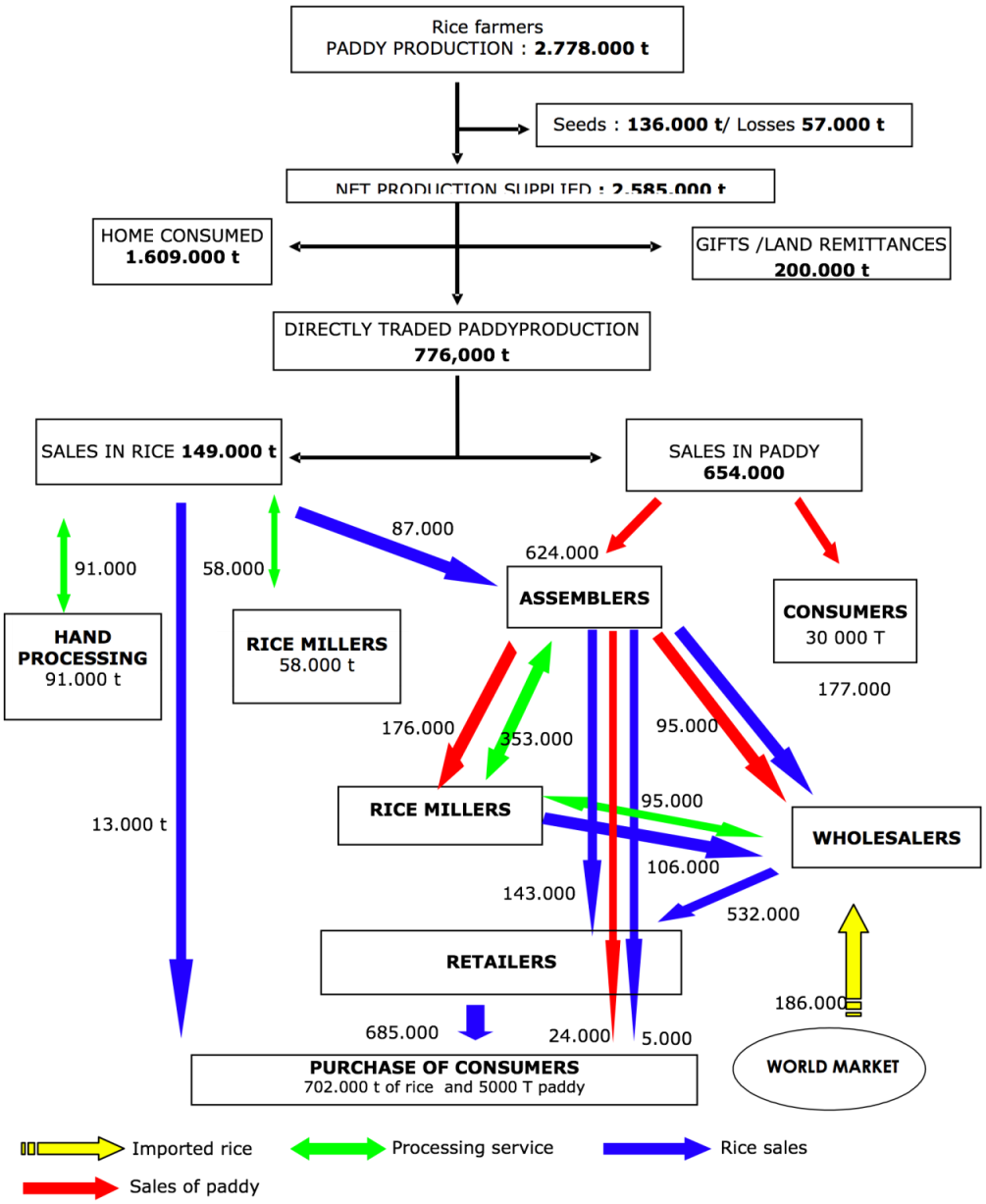


Figure 1: Physical paddy and rice flows (Thailand, 1999).
Based on Etude FAO/UPDR, taken from Tallec and Bockl, 2005

Filière analysis (translated as Commodity Chain Analysis, CCA) was developed by researchers at the Institute 'National de la Recherche Agronomique (INRA)' and the 'Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD)' (Raikes et al, 2000). It is applied to the analysis of existing marketing chains for

primarily agricultural commodities, assessing how public policies, investments and institutions affect local production systems (Tallec and Bockl, 2005 and Raikes at al, 2000).

Filière analysts have borrowed from different theories and methodologies, including systems analysis, industrial organization, institutional economics (old and new), management science and Marxist economics, as well as various accounting techniques with their roots in neo-classical welfare analysis (Kydd et al., 1996: 23). An *empirical research tradition* has been dominant from the beginning. The main objective of *filière* analysis has been to map out actual commodity flows and to identify agents and activities within a *filière*, which is viewed as a physical flow-chart of commodities and transformations. An example of such a chart is given above (**Figure 1**). The *quantitative tradition* of *filière* analysis has mainly attempted to measure inputs and outputs, prices and value-added along a commodity chain. In addition there exists the *anthropological tradition* within *filière* work. This focuses on markets and power in a 'real world' sense. From this point of view, it relates to the GCC approach (Raikes et al., 2000).

References

Gereffi, G. (1996): "Global Commodity Chains: New Forms of Coordination and Control Among Nations and Firms in International Industries." *Competition and Change* 4: 427-439.

Hopkins, T. and Wallerstein, I. (1986): "Commodity chains in the world economy prior to 1800", *Review* X (1):157-170.

Kydd, J., Pearce, R. and Stockbridge, M. (1996): The Economic Analysis of Commodity Systems: Environmental Effects, Transaction Costs and the Francophone Filière Tradition, presented at the ODA/NRSP Socio-Economics Methodology (SEM) Workshop, ODI: London, 29-30 April 1996.

Raikes,P. Jensen, M., F. and Ponte□□□ S. (2000): Global Commodity Chain Analysis and the French *Filière* Approach: Comparison and Critique. *Economy and Society* 29(3), pp. 390-417

Tallec, F. and Bockl, L. (2005). Commodity Chain Analysis. Constructing the Commodity Chain Functional Analysis and Flow Charts. Food and Agriculture

Organization of the United Nations (FAO), Rome, Italy. Online under: www.fao.org/tc/easypol

11. Commodity Frontiers

Concept

The search for materials to supply the countries at the centre of the global economy has already extended into the most remote corners of the world. To some extent this is due to resource scarcity as the most accessible deposits have been exhausted. Since we are very near the Hubbert peak in oil extraction (with about half of known reserves already having been extracted) the search for oil has expanded to pristine territories such as the Amazon, and under the world's oceans deep into the sea bed. These "commodity frontiers" are sometimes inhabited by indigenous peoples who have conserved biodiversity. In South America, some of these peoples have not been previously contacted by the outside world.

The "commodity frontiers" for metals are places where the ores are rich, however distant they are from the centres of consumption. Mining companies move into new territories looking for old or new metals or other materials (coal, gas, uranium). At other times, the "commodity frontiers" are situated in new territories suitable for their

11.1 Land Grabbing

Used in earlier times, the notion of land grabbing has had mainly political connotations, referring to the aggressive taking of land, often by military force, for the expansion of territorial holdings or broadening of power. More recently however the term has been applied to the global rush of corporations or countries to buy up or lease farmland abroad in order to secure basic food and / or water supplies or simply for profit speculation. The report by GRAIN, Seized: The 2008 land grab for food and financial security, issued in October of that year documents land grabbing activities, citing the seriousness of threats to local communities across the globe:

"Today's food and financial crises have, in tandem, triggered a new global land grab. On the one hand, "food insecure" governments that rely on imports to feed their people are snatching up vast areas of farmland abroad for their own offshore food production. On the other hand, food corporations and private investors, hungry for profits in the midst of the deepening financial crisis, see investment in foreign farmland as an important new source of revenue. As a result, fertile agricultural land is becoming increasingly privatised and concentrated. If left unchecked, this global land grab could spell the end of small-scale farming, and rural livelihoods, in numerous places around the world."

The CEECEC case study, Let Them Eat Sugar highlights land grabbing moves in Kenya's Tana Delta, where the government of Qatar hopes to lease an area of 30 000 ha in exchange for a loan to build a 3.4 billion dollar port in Lamu. The government of Qatar would provide the technical know-how and the technology for the agriculture project and all the produce, probably fruits and vegetables, would be shipped back to Qatar. Another project under development for the area involves the leasing of land at 1$ a hectare to a Canadian company, Bedford Fuels, that plans to plant jatropha for biodiesel in a $300 million project.

climate conditions for crops or other materials for the production of inputs for global economic centres. Sugarcane, tea, coffee, and soybean plantations are examples of commodity frontiers, as are tree plantations for rubber or cellulose, or oil palm plantations for biodiesel. “Land grabbing” comes from the expansion of the frontiers of extraction.

Advancing Frontiers

The advance of commodity frontiers is driven by economic growth and population growth. However, even without these sources of growth, there would be need for fresh supplies of fossil fuels, metals and biomass. This is because when energy is spent it cannot be recycled (see Entropy), and because materials can only ever be recycled to a limited extent.

References

J.W. Moore (2000), "Sugar and the expansion of the early modern world-economy: Commodity frontiers, ecological transformation, and industrialization", *Review: Fernand Braudel Center*, Vol. 23 pp.409 - 433.

Websites

http://farmlandgrab.org/

12. Common Pool Resources

Definitions

According to Ostrom (2008), scholars are still in the process of developing a shared language for the broad set of things called “the commons”. There is frequently confusion about similarities and differences across concepts such as “common-pool resources”, “common-property resources”, “open access resources”, and “commons” in general.

Ostrom (2008) considers that “commons” refers to systems, such as knowledge and the digital world, in which it is difficult to limit access, but one person’s use does not subtract a finite quantity from another’s use. This definition is close to the “public good” definition in economics. Public goods are simultaneously characterized by non-exclusivity (implying that resources can be exploited by anyone since nobody has an exclusive right) and indivisibility (implying that the use of part of the resource by one individual or group does not subtract from the amount available to others).

The “common-pool resources” are characterized by divisibility, which makes a difference to public goods, and include open access resources as well as common-property resources, in opposition to private property resources. The latter are held by

individuals and firms creating the basis for the functioning of markets. Ostrom (2008) sees common-pool resources as "...sufficiently large that it is difficult, but not impossible, to define recognized users and exclude other users altogether. Further, each person's use of such resources subtracts benefits that others might enjoy". For instance, one person using open air to breath, does not hamper anybody's else's use, while using the atmosphere as a dumping ground for large amounts of sulphur dioxide, prevents other people from making (without damage to all) a similar use of it.

Common and Stagl (2005) consider that common property resources include cases where rights are held by communities of individuals, including the government and non-government organizations, and their use can be regulated in a variety of ways by a variety of institutions. Sometimes, property rights exist for common-pool resources, but it is so expensive to enforce them that they are not exercised. In this case, the common-pool resource has a size or characteristics that make it costly, although not impossible, to exclude potential beneficiaries from obtaining benefits from their use.

But, besides the property rights enforcement constraints, it must be recognized that not everything is subject to property rights of some kind. For this reason, we need to consider also open-access regimes where no one owns or exercises control over the resources. Open access resources can be considered a type of common-pool resources where anyone can enter and/or harvest.

Consequences

Open access resources can be exploited on a first-come, first-served basis because no individual or group has the capacity or the legal power to restrict access, promoting a "use it or lose it" situation (Tietenberg and Lewis, 2009). Individuals making decisions on the basis of benefits and costs to themselves will ignore the common-property externalities they inflict on others. Each individual has no incentive to reduce the rate of use and conserve the resource. Economic theory considers this a "market failure" and suggests several direct consequences, concluding that these resources are often overexploited.

The open access problem is known popularly but incorrectly as the "tragedy of the commons", corresponding to the title of a famous article by theecologist Garrett Hardin, published in the journal *Science* in 1968. Hardin confused open-access commons with commons that are the joint property of a community, as stressed by Ostrom (2008): "While Hardin correctly pointed out that valuable open-access common-pool resources would be overharvested, his conclusion of an inevitable tragedy was too sweeping".

Open access resources are overexploited and generally violate both the efficiency and sustainability criteria, although in the absence of scarcity both criteria are not

threatened. Common property resources need not suffer over-use and their allocation can be regulated in a way that avoids tragedy.

In synthesis, the shared elements in the definition of common-pool resources include partial or total non-exclusivity - implying that resources can be exploited by any one/community since nobody individually has an exclusive right, and divisibility - implying that the use of part of the resource by one individual or group subtracts from the amount available to others.

Management of the Commons

Fisheries and forests are examples of two common-pool resources that are currently of great concern. Some authors also rightly refer to groundwater basins, pastures and grazing systems, lakes, oceans, and the Earth's atmosphere. According to Ostrom (2008), in the two decades that followed the World Commission on Environment and Development (WCED) report - *Our Common Future* (1987), "...humans have failed to halt the tragedy of massive overfishing of the oceans, major deforestation, and excessive dumping of carbon dioxide in the atmosphere. However, in some specific niches, such as the Maine lobster fishery, the commons are in better condition today than they were a decade or two ago". For this author part of the reason for the mixed results is that most common-pool resources differ vastly from one another. Differences can be found, for example, on the resource characteristics, socio-economic and cultural contexts, and scales. However, granting due importance to management systems and property rights, it must be said that the main driving force of exhaustion of resources is population and economic growth.

The adequate management of a common-pool resource requires a deep understanding about the causes of the (potential/existing) conflict in resource use. Adams et al (2003) emphasize that conflicts over the management of common pool resources are not simply material, as they also depend on the perceptions of the protagonists. Since the problem definition is a critical phase in the policy making process, it is essential a careful and transparent consideration, for the different stakeholders, of their knowledge of the empirical context, knowledge of laws and institutions, as well as beliefs, myths, and ideas. It is essential to promote an effective dialogue to find an adequate policy regime.

Ostrom (2008) defends that the advocacy of a single idealized solution for all common-pool resources has been a key part of the problem instead of the solution. She also considers that many of the most pressing problems future generations will face are on a global scale and that establishing effective governance arrangements on this scale has proved to be more difficult than on a local one. Ostrom argues that common-pool resources may be governed and managed by a wide variety of institutional arrangements that can be roughly grouped as governmental, private, or community ownership, or mixed approaches like the co-management by communities working with governments. The success or failure of each alternative in sustaining resources and providing good economic returns depends on the specific

setting. The use of pricing approaches to regulate the use of common property resources, namely those held by the government, is also becoming more widespread.

References

Adams, W., Brockington, D., Dyson, J., Vira, B., 2003. Managing Tragedies: Understanding Conflict over Common Pool Resources. Science, vol. 302, nº 5652, pp. 1915-1916.

Common, M., Stagl, S., 2005. Ecological Economics – an introduction. Cambridge University Press, Cambridge.

Ostrom, E., 2008. The Challenge of Common-Pool Resources. Environment, July/august 2008 (available at http://www.environmentmagazine.org/Archives/Back%20Issues/July-August%202008/ ostrom-full.html).

Tietenberg, T., Lewis, L., 2009. Environmental and Natural Resource Economics. 8th edition, Pearson International Edition, Addison Wesley, Boston

13. Complexity

Definition

Complexity is a condition of systems composed of many interconnected parts, where the behavior of the whole system cannot be fully understood by simply analyzing the behaviour of its components.

Complex systems are adaptive and generate a new quality of collective behaviour through self-organization. They are frequently characterized as having extreme sensitivity to initial conditions as well as emergent behaviour that are not predictable or completely deterministic (Meyers, 2009). Failing to understand complexity often leads to policy resistance and the worsening of problems. Ignoring the time and spatial distance between causes and effects typically results in policies that generate transitory improvement before the problems grow worse (Sterman, 2000).

According to Sterman (2000), natural and human systems combine several characteristics which give rise to complexity:

- **Dynamics**, systems change at many different and sometimes interacting time scales;

- **Tight couplings**, which reflects the notion that “everything is connected to everything else”, given the multiple intra and inter relationships between actors and natural systems;

- **Feedback**, where decisions made in tightly coupled systems lead to actions which influence subsequent decisions;

- **Non-linearities,** characterizing relationships where the effect is not proportional to cause;

- **History-dependence,** wherein some decisions create path dependence, precluding alternative options and leading to irreversible actions;

- **Self-organization,** describing situations where behaviour arises spontaneously from the internal structure of systems. Small and random perturbations are often amplified and molded by the feedback structure generating different time and spatial patterns;

- **Adaptiveness,** relating to changes in the capabilities and decision rules of the agents in complex systems, leading to evolutionary and learning processes.

Several mathematical and modeling methods and tools (e.g. agent based modeling, cellular automata, game theory, system dynamics) have been progressively applied to scientific, engineering, and societal issues that can only be adequately described in terms of complexity and complex systems (Meyers, 2009).

Complex systems are becoming the focus of innovative research and application in many areas, providing a theoretical justification for a post-normal approach to the management of science-related issues (Funtowicz and Ravetz, 1994). Such is the case in ecological economics, where the engagement of complex knowledge communities has been increasingly advocated for responding to complexly interacting socio-physical systems and environments (Henshaw, 2010).

References

Funtowicz, S., Ravetz, J. 1994. Emergent Complex Systems. *Futures*, 26 (6), 568-582.

Henshaw, Philip (Lead Author); Mark McGinley (Topic Editor). 2010. "Complex systems." In: Encyclopedia of Earth. Eds. Cutler J. Cleveland (Washington, D.C.: Environmental Information Coalition, National Council for Science and the Environment). [First published in the Encyclopedia of Earth January 18, 2010; Last revised January 25, 2010; Retrieved February 7, 2010]. <http://www.eoearth.org/article/Complex_systems>

Meyers, R. 2009. *Encyclopedia of Complexity and Systems Science*. Springer, New York, USA.

Sterman, J. 2000. *Business Dynamics. Systems Thinking and Modeling for a Complex World*. McGraw-Hill, USA.

Websites

http://comdig.unam.mx

http://www.springer.com/physics/complexity

http://complexityblog.com/

14. Consumption

Definition

A social phenomenon characteristic of all societies in all times, consumption may be defined as the acquisition, use, and destruction of goods and services. It is comprised of the value of goods and services bought by people, as individual purchases are aggregated over time and space. Consumption is then the aggregate of all economic activity that does not entail the design, production and marketing of goods and services, and usually represents the largest component of GDP. Many persons judge the economic performance of their country mainly in terms of consumption level and dynamics. Current income is the most relevant determinant of consumption.

Classification and patterns

Consumption may be classified according to the durability of purchased objects. In this vein, a broad classification separates durable goods (such as cars and television) from non-durable goods (as in food) and from services (as in a restaurant). These three categories often show different paths of growth. In Western countries, consumption has steadily grown over the last 60 years, with the exception of a few deep recessions. Consumption growth has been smoother than that of increases or decreases in private investment or of net export growth. In particular, services have always systematically grown (measured in economic value and in employment statistics) at a fairly steady pace, non-durables have often mirrored the business cycle and durables have often over-shot fluctuations in GDP.

Goods and services are consumed for the satisfaction of needs and wants. Expenditures are influenced by many different factors besides income: general lifestyles, habits, age of the household's members, attitudes toward savings or consumption, a standard level of consumption to maintain or improve over time, decisions regarding active saving strategies, opportunities to obtain consumer credit, past acquisition decisions, innovative sales proposals, and sensitivity to advertising. While orthodox, neoclassical economics insists on "consumer sovereignty", meaning the right of consumers to reveal their preferences in the market buying whatever they want to buy, other traditions in economics (such as the institutional economics of Thorstein Veblen) have tried to find and explain social patterns in consumption. Veblen coined the expression "conspicuous consumption" to account for the behaviour of buyers who buy prestigious goods in order to show their priviliged position in the social hierachy.

in the 1970s Fred Hirsch came very close to taking an environmentalist position when he applied the term “positional goods” to products or services (such as waterfront holiday houses, golf-club membership in arid countries) that are exclusive by nature, and would be inaccessible to the majority of the population even if incomes were to increase. Taking this perspective, one could ask whether automobiles too are “positional goods” at a global level. Viewed critically, marketing literature, as well as the literature on advertising can be used to classify and understand patterns and social motivations of consumption.

In economic theory, there is in general a presumption that goods can substitute for each other. If the price of apples goes up, people will buy pears instead. Exceptions to that rule give rise to the notion of “lexicographic preferences”. These are seen as very special cases, as when people in willingness-to-accept-compensation surveys refuse to give up a beautiful landscape or to accept the loss of a species at any price. But this type of preference is not so strange. From a biological point of view, we know that the minimum required amount of water or of food (energy for endosomatic use), cannot be substituted by anything else. In ecological economics, therefore, we dispute the view that consumption is to be explained only by subjective, inscrutable preferences.

14.1 Sustainable consumption

In terms of natural resources, orthodox economics indeed forgets totally that all consumption entails material flows and energy transformation, as well as the work of other people. Contemporary forms of consumption however frequently raise the question of sustainability, so that today most people are somewhat aware that the human species is leaving a legacy of destruction: climate change, biodiversity loss, depletion of various minerals and fuels. Over the past decade an increasing amount of research has intersected consumer issues with environmental degradation. For example, the consumption of many kinds of new household technologies is associated with the consumption of energy, water and other resources. From an ecological economic point of view we face a clear dilemma: on the one hand environmental pressures require that consumption be curbed, probably in absolute terms. On the other hand most economists hold that consumption is closely related to welfare and should grow without limits.

Policy focus

Consumer behaviour is an important determinant of the impact that society has on the environment. The actions that people take and the choices they make – to consume certain products and services rather than others or to live in certain ways - all have direct and indirect impacts on the environment, as well as on personal (and collective) well-being. This is why the topic of ‘sustainable consumption’ has become a central focus for national and international policies. Max-Neef’s distinction between “needs” and “satisfactors” of needs is here very pertinent.

The questions posed by sustainability today are more and more focused on the problem of consumption patterns. In this context, sustainable consumption calls for integrating a series of problems. “Sustainable consumption is an umbrella term that brings together a number of key issues, such as meeting needs, enhancing quality of life, improving efficiency, minimising waste, taking a lifecycle perspective and taking into account the equity dimension.” (UNEP, 2001) Unsustainable lifestyles and practices however continue to dominate. Material and energy flows have to decrease at the global level, but how this might be achieved is not clear.

Consumers are seen as multiple and diffuse sources of pollution. In this context, governments rely primarily on increasing consumer awareneness and providing better information about the impacts that products generate in order to help consumers make better choices. But current policies affect the foundations of these choices very little: freedom of action is justified by a free and unfettered market. Sustainable consumption asks us to consider issues that go beyond the individual when we shop. These include not only the ecological impacts of what we buy but also the equity, human rights and political dimensions of sustainability in the production and consumption process of goods and services.

Redefining and addressing consumption

In adopting an ecological perspective, we can return to the etymology of consumption. Consumption comes first from *cum-summa*, which means making the sum, completing, achieving. It would be wise to shift the definition of consumption from one that has come to inherently imply destruction for the sake of human pleasure, back to the etymological roots of the word, to a definition that emphasises, appreciates, and is compatible with the interwoven processes of engaging in relations with the (human and non human) beings in our environment, that complete us as human beings.

To avoid unrealistic propositions in pursuit of sustainable consumption however, social functions of consumption have to be understood. The history of consumption shows us how today’s consumer society is extremely fragmented and multiple, focused on a multitude of individuals. This recent social pattern is based on the promotion of individual choices and actions. The rhetoric of ‘consumer sovereignty’ is counter-productive because it regards choice as individualistic and fails to unravel the social, psychological and institutional influences on private behaviours. What we decide to buy is influenced by many factors, including our age and health, place of residence, income and wealth, moods and social beliefs and relations.

Studies of consumption investigate how and why groups and individuals consume goods and services, and how this affects society and human relationships. Contemporary studies focus on meanings of goods, role of consumption in identity making, and the 'consumer' society. Consumption is not only a way of meeting needs, but also a manner for producing social interactions, and constructing relations

to the world through objects. Challenging commodity consumption and accumulation of objects requires other social forms, necessarily more collective. Essential questions in consumption analysis are therefore first, “How do products find their ways into people’s lives?”, and second, “How do they affect and how are they affected by daily practices?”.

References

John Lintott (1998), Beyond the economics of more: the place of consumption in ecological economics, *Ecological Economics* 25 (1998) 239 – 248

UNEP (2001), *Consumption Opportunities: Strategies for Change*, United Nations Environment Programme, Paris.

Tim Jackson, Motivating Sustainable Consumption. A review of evidence on consumer behaviour and behavioural change. A report to the Sustainable Development Research Network, 2005 : http://www.comminit.com/en/node/219688

15. Corporate Accountability

Corporate accountability can be defined as the ability of those affected by a corporation to control that corporation’s operations. This concept demands fundamental changes to the legal framework in which companies operate. These include environmental and social duties being placed on directors to complement their existing duties on financial matters, and legal rights for local communities to seek compensation when they have suffered as a result of directors failing to uphold those duties (Friends of the Earth, 2005).

Instead of urging companies to voluntarily give an account of their activities and impacts to improve their social and environmental performance, the corporate accountability “movement” believes corporations must be “held to account” – implying enforceability. This is a more radical position than that of CSR (corporate social responsibility) advocates. Over the years, NGOs and local stakeholders around the world have fought countless campaigns against companies over specific issues. Sometimes, firms have been brought to court. Well known cases have arisen under the US ATCA (Alien Tort Claims Act) statute, two well known ones being one from Ecuador against Chevron-Texaco, and another from Bhopal in India against Union Carbide (later Dow Chemical). Such court cases have demanded compensation for the environmental liabilities (or ecological debts) left behind by companies.

Consumer campaigns have persuaded thousands of shoppers to buy recycled paper, fair trade and organic coffee, tea, chocolate and bananas, GM-free food, timber that has been certified as sustainable by the Forest Stewardship Council

(FSC), and so on. This is called Green Consumerism. From a corporate accountability perspective, green consumerism and voluntary CSR places a focus on the consumer and on the individual company (often located in the North) and ignores the issues of social and environmental justice for communities (often located in the South).

This begs the question of whether it is right for Northern governments to put the onus on individual and corporate voluntarism, while sitting back and doing nothing as indigenous communities are pushed off their land and rainforests cleared to produce cheap bauxite, oil or gas, or palm oil for Northern consumers? NGOs say that if we are serious about social and environmental justice, the time has surely come to mainstream common standards on social and environmental performance. The way to do this is through changes to the legal framework that would allow people to hold corporations to account for social and environmental wrongdoing.

As summarised by the United Nations Research Institute for Social Development (UNRISD), the emerging corporate accountability agenda includes proposals to establish institutional mechanisms that hold corporations to account, rather than simply urging companies to improve standards or to report voluntarily. Corporate accountability initiatives promote complaints procedures, independent monitoring, compliance with national and international law and other agreed standards, mandatory reporting and redress for malpractice.

References:

Clapp, J. and P. Utting, eds. Corporate Accountability and Sustainable Development, Oxford University Press, Delhi, 2008.

Friends of the Earth, Briefing: Corporate Accountability, April 2005. Acessed 01 March, 2010 from http://www.foe.co.uk/resource/briefings/corporate_accountability1.pdf

Websites:

http://stopcorporateabuse.org/our-history

16. Corporate Social Responsibility

Background

The belief that business has a social responsibility is not new. In the early decades of the 20th century a few large industrialists, including Ford and Carnegie engaged in corporate charity and took measures (in education, health-care, and housing) to improve the conditions of workers and communities in which their factories were

located (Utting, 2000). Corporate social response broadened slightly in the 1950s when social democracy and welfare legislation took root, and then in the 1960s and 1970s CSR emerged briefly as a high-ranking management concern in the US and Europe, in response to high profile international boycotts, including that against Nestle's aggressive marketing of baby formula in the South as a "safer" alternative to breast feeding (Klein, 2000).

Since then, Corporate Social Responsibility (CSR) has emerged as a form of voluntary self-regulation for firms for managing their engagement with society in the face of increasing pressure from organized civil society and the general public to address the negative environmental and social impacts of companies, particularly transnational ones. From a political economy point of view the ascendancy of contemporary CSR is traceable to the deepening of economic globalization under neoliberalism, and the emergence of its political counterpart, "the good governance agenda" (Hoogvelt, 2001).

Implementation

CSR broadly acknowledges that firms are more than just producers & sellers, with legal and moral obligations in terms to the people they employ, their customers, neighbours, future generations, and thus to society at large. CSR initiatives frequently focus on the conception, implementation and monitoring of internal charters steering internal decisions on social responsibility. Operationally, CSR embraces issues which range from reducing negative environmental impacts on production sites and of products, respecting workers' rights, implementing racial and social anti-discrimination policies, and ensuring financial and managerial transparency. Among the cornerstones of CSR mechanics are monitoring and reporting processes.

The enormous success of CSR initiatives today has a great deal to do with their internationalisation and standardization through transnational institutions and networks, such as the Global Compact of the United Nations. The Global Compact asks that signatories commit to principles of transparency, implementation of external monitoring, and to pro-actively implement partnerships - or at least some form of engagement - with civil society. The Global Reporting Initiative (GRI) is a standard set of monitoring and reporting processes and indicators. CSR initiatives however are mainly driven by the need for corporate risk management, and often geared toward buying "social license to operate".

As such, much CSR activity is still situated in corporate governance and risk-management departments. This is reflected in the increasing role of CSR in intra-firm business mechanisms, with transnational corporations requiring their manufacturers to adopt CSR policies in order to protect themselves from liabilities that might be incurred down their manufacturing lines and/or supply chains. Adopting a CSR policy has also become a prerequisite in some countries or sectors for participation in public procurement processes.

Problems and concerns

A very large and lucrative industry of private consultancy has evolved around CSR processes. Structurally, the very existence of the CSR industry encourages the *de facto* outsourcing of the bulk of CSR activities, which ironically jeopardizes the internalization of the CSR ethos by business models and throughout all levels and departments of firms, including accountancy. The environmental liabilities of firms are not included in their balances and "bottom lines", unless they become due through court cases or social agitation. (See the UMICORE case in Hoboken, Flanders).

A major concern with CSR is that corporations can quite easily implement apparently robust policies without having to change actual behaviors or reduce impacts on the environment or on people (Clapp 2008). CSR is implemented as an add-on to "business as usual" and initiatives often boil down to a series of statements, overarching policies, charters and monitoring programs which are concluded with an annual set of social partnerships and social sponsoring programs, with little effect. While some proponents sincerely believe CSR means fundamentally changing business practices with respect to social /environmental responsibility, others feel that CSR at best leads to greenwashing.

Accordingly, CSR policies have attracted the attention of NGOs that have emerged to scrutinize CSR reports and compare them with actual corporate behavior. NGOs use CSR policies and reports as leverage with which to expose and influence companies' that violate their own codes of conduct, but this work can be challenging because it is not in the interest of companies to render their functionings entirely transparent, and because the accurate and detailed monitoring and follow-up of CSR claims is very time and resource consuming. For these reasons some NGOs accept funding indirectly, for instance via business councils to which the firms in question are members, losing their independence and ultimately becoming co-opted.

There is also the scientific challenge of assessing the interactions and causalities between corporate CSR performance and financial performance. Whether a robust CSR policy improves business performance is highly questionable. While some early evidence points to the existence of some relationships between both strands of performance, their direction and prescription is far from having been ascertained (Scholtens 2008). The lack of evidence to this effect means that in hard financial times, CSR programmes are the first to be cut under corporate belt-tightening measures.

References

Bazin D. (2009). What exactly is corporate responsibility towards nature? Ecological responsibility or management of nature? A pluri-disciplinary standpoint. *Ecological Economics*, Volume 68, Issue 3, 15 January 2009, Pages 634-642.

Clapp J. (2008). Illegal GMO releases and corporate responsibility: Questioning the effectiveness of voluntary measures. *Ecological Economics*, Volume 66, Issues 2-3, 15 June 2008, Pages 348-358.

Scholtens B. (2008). A note on the interaction between corporate social responsibility and financial performance. *Ecological Economics*, Volume 68, Issues 1-2, 1 December 2008, Pages 46-55.

Utting, Peter, (2000) Business Responsibility for Sustainable Development, Occasional Paper No.2. Geneva: UNRISD.

17. Customary Rights

Customary rights and legal pluralism

"Customary rights" refer to established, traditional patterns of norms that can be observed within a particular socio-cultural setting. Sets of customary rights and obligations may be called customary law. Customary rights exist where there is a consensus of relevant actors considering them to be "law".

In practice, today, customary law often coexists with formal state law. Such situation corresponds to legal pluralism. Plural legal systems are particularly prevalent in former colonies, where the law of a former colonial authority exists alongside customary legal systems. Economic transactions (sales, rents, wages, credit) are typically governed by Western-type law while non-economic aspects (family, marriage, inheritance) often remain covered by traditional law. Legal pluralism also occurs when different laws govern different cultural groups within a country. For example, in India there are special Islamic courts that address concerns in Muslim communities by following principles of Islamic law. Secular courts deal with the issues of other communities. Legal pluralism also exists to a certain extent in societies where the legal systems of the indigenous population have been given some recognition. Land and environmental conflicts typically occur and they are often expressed as struggles between customary and state legal systems.

The example of Cameroon

Let us give an illustration. The customary rights of Bantu and Baka/Bagyeli societies in Southern Cameroon have been under threat since the beginning of the colonial period, when, in 1896, the German administration introduced written norms using the questionable concept of "vacant and ownerless lands". In this way, the different colonial administrations were able to appropriate land and resources by transforming Bantu and Baka/Bagyeli customary forests into state property. From 1960 onwards, the independence of Cameroon was not associated with a rupture in this legal philosophy. This can be explained by the fact that pro-Western elites took control of

the newly-independent country and that the genuine independence movement was largely suppressed by the French army. Despite local resistances against the first post-colonial legislations, this process of land appropriation culminated with the 1974 law, still the basis of today's land regime. The colonial notion of "vacant and ownerless land" was retaken for the benefit of the state and ambiguously recognized a limited space for customary institutions. The latter nevertheless remain by far, today, the dominant law in the villages of Southern Cameroon. In this transition from customary systems to capitalism, in Cameroon as elsewhere across the globe, such situation of legal pluralism was – and still is – at the origin of an incalculable number of fierce conflicts between state or private companies exploiting state concessions, and local communities still largely ruled by customary law. Or, rather, the conflicts at these extractive commodity frontiers arise from the threats to local livelihoods, and are expressed as conflicts between legal systems.

References

Diaw, M.C., 2005. Modern economic theory and the challenge of embedded tenure institutions: African attempts to reform local forest policies. In: Sustainability institutions and natural resources: institutions for sustainable forest management (Eds. Kant, S. and Berry, A.), pp. 43–81. Amsterdam: Springer.

Thompson, E.P., 1991. Customs in common: studies in traditional popular culture. London: Merlin Press.

18. Dams (Krutilla's method)

The development of dams

From the 1930s onwards, dams have been built in most rivers in the world. The Amazon still flows freely, though no longer some of its tributaries. The promotion of large dams, through the new technique of cost benefit analysis of multi-purpose river development, spread from the USA from the 1940s, promoted especially by the World Bank. By this peculiar accounting technique, all present and future values obtained or sacrificed by building a dam, are reduced to a money numeraire, and discounted at present-value. Thus, the costs of building the dam, of buying land and compensating for displacement, the estimated costs of lost fisheries downstream and for lost sediments, are listed and added up in one column, at present (discounted) monetary values, and compared to the benefits in the form of a electricity produced, and of irrigation water also at present monetary values. As we see, externalities are included, valued in money. Cost-benefit analyses have more recently been complemented with the cosmetics of environmental impact assessments**,** which exclude money values. An integrated economic, ecological, social and cultural assessment is not normally practiced although this was recommended by the World Commission on Dams in 2000.

Resistance against dams

The early social hopes placed on hydro-electricity, have been betrayed. Hydro-electricity has been associated with water use for enormous irrigation schemes or for making water available for sprawling urban growth as in southern California. Hydro-electricity is also associated with the export of aluminium, as in Brazil, Venezuela and Ghana. There is a new awareness of the perils from dams such as loss of sediments and silt in deltas; increased local seismicity; salinization of soils in irrigation schemes; loss of fisheries; new illnesses; methane emissions; degradation of water quality; loss of fertile agricultural land; loss of riverine biodiversity; loss of cultural monuments; and risk of dam failure.

Only about one-fifth of all electricity produced in the world is hydro-electricity, but the environmental and social effects of dam building have been enormous (McCully, 1996). In some countries like the USA, little unused potential is still available, and there is even talk of "decommissioning" some dams in the West of the country in order to restore the natural flow of rivers. Decommissioning is also discussed in Third World countries. In Thailand, a leader of the Assembly of the Poor, after fighting for years against the Pak Mun Dam, claimed success in June 2000 when the government agreed to keep open the dam's sluice gates so as to allow the fish to come back to the river. In the world at large, the damage from further possible large dams is larger than that already done. The Sardar Sarovar dam, built on the Narmada River in central India, is intended to stand as a showpiece of Indian economic development. It promised to provide "much-needed irrigation and electricity, but it shall also submerge historic old temples, rich deciduous forests, and at least 250 villages" (Guha, 2000: 100). In reaction a famous protest movement arose – the Narmada Bachao Andolan (Save the Narmada Movement) – lead by Medha Patkar. She and her colleagues fasted outside provincial legislatures, camped outside the Indian Prime Minister's house in New Delhi, and walked through the Narmada valley to raise awareness of the predicament of the displaced villagers.

Can cost benefit analysis be the solution?

Cost benefit analysis cannot provide a rational answer either for the commissioning or the decommissioning of dams because the money-values are contingent on the acceptance of a given structure of social and environmental inequality. Thus, the cost of displacing people will depend on their degree of poverty, and also on their degree of resistance should they refuse to accept the distribution of property rights to the river water and to the environment which the State and the electricity companies defend as being legal. Prices (in actual or fictitious markets) depend on distribution. Moreover, prices are only one type of value among many.

Krutilla's Modified CBA

Within mainstream resource and environmental economics, there has been concern for the natural amenities endangered by energy-producing activities. According to this tradition, because of technological change and substitutability (weak sustainability), there will be no scarcity of resources for the production of a

commodity like electricity. However beautiful, landscapes threatened by hydroelectric dams, geomorphological wonders such as the Grand Canyon, and irreplaceable biological diversity will become increasingly scarce and increasingly valued. For that reason, economist John Krutilla proposed a modified cost benefit analysis in order to give more weight to natural amenities.

In a famous case, Krutilla (1967) defended mountain landscapes against hydroelectricity by arguing the electricity would be cheaply available in the future, while landscapes would become more valuable with time. Technology will not advance to the point at which the beautiful landscapes could be replicated (or extinct species resurrected), while the supply of fabricated goods and commercial services would be, in his view, capable of continuous expansion due to technological improvements. He was thinking mainly of cheap nuclear energy. Hence Krutilla's criterion: to modify discount rates to be applied to the stream of benefits (kwh) and to the opportunity costs (loss of landscape amenities) in order to obtain their "corrected" present-values. For Krutilla, environmental amenities such as mountain landscapes or coral reefs will increase their relative scarcity with time, and therefore we should discount their present value at a zero or very low rate of discount.

The background to this analysis is the common and questionable assumption that economic growth is good for the provision of energy and materials, and for correcting the damage caused to the environment. There are two objections to Krutilla's criterion, reflected in the following questions: Will commodity resources really become cheaper (including environmental costs) relative to amenity resources? Why are the natural conditions of livelihood and production, which are not yet commodities, and which are not really "amenities", left out of such analyses?

Conclusion

We know that resistance against large dams often stems from the need to defend the natural conditions of livelihood and production of local populations. Sometimes, in the North, resistance movements bring forward concerns related to "amenity" values or "deep ecology" values, while in the South, as in the movement by the *atingidos por barragens* in Brazil, human material livelihood is often a supreme value compatible with aesthetic concerns and with respect for other forms of life, and indeed also, sometimes, with an appeal to sacredness: "An argument often used by dam builders and backers in developing countries (...) is that concern for the environment is a 'first world luxury' which they cannot afford. In fact the opposite is the case" (McCully, 1996: 58). Opposition to dams in such cases is rather a manifestation of the "environmentalism of the poor".

References

Guha, R., 2000. *Environmentalism: a global history*. Oxford: Oxford University Press.

Krutilla J, 1967. Conservation reconsidered. *American Economic Review*, 42(4): 777-786.

Martínez-Alier, J., 2002. *Defending the rivers against development, and other water conflicts*. School of Geography and the Environment, University of Oxford, April 24-25, 2002.

McCully, P., 1996. *Silenced rivers: the ecology and politics of large dams*. London: Zed.

19. Decoupling and Dematerialization of the Economy

Definition

The MEFA (Material and Energy Flow Analysis) framework provides a tool to monitor progress in terms of the decoupling (disconnection or separation) of economic and social well-being from the use of biophysical resources. Decoupling may occur in at least three relations: (1) economic growth— e.g. as measured by GDP growth—may be decoupled from material and energy throughput (an increase in ‘‘efficiency’’ leading to ‘‘dematerialization’’), (2) material and energy throughput may be decoupled from social well-being (‘‘sufficiency’’), and (3) social well-being may be decoupled from economic growth (‘‘equity’’) (Haberl et al. 2004). This is shown in the model below.

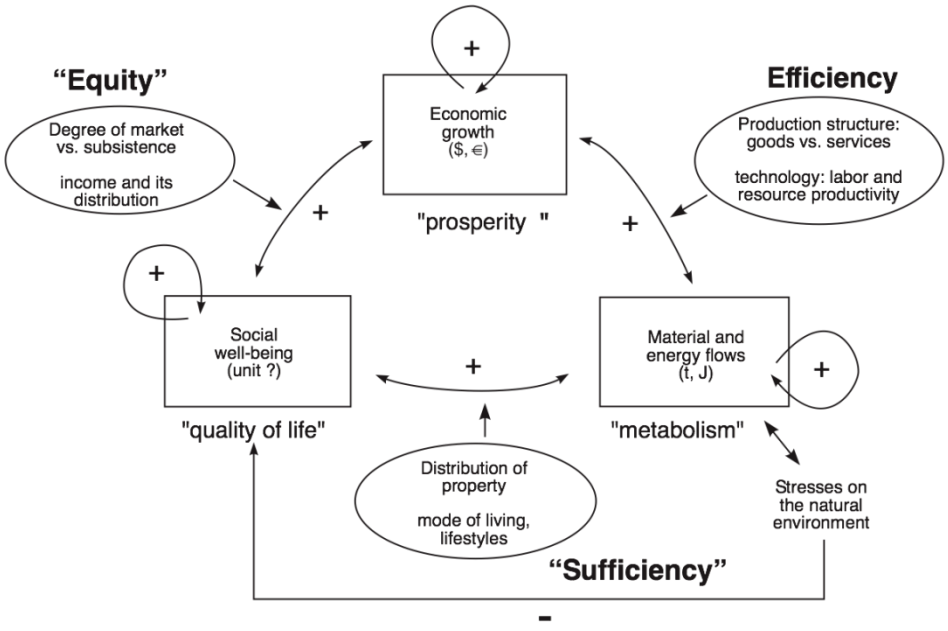


Figure1 : Interrelations of material and energy flows, economic growth, and social well-being.
(Source: Modification of Fischer- Kowalski and Haberl (1998), taken from Haberl et al. 2004)

Observed Patterns

According to Haberl et al. (2004) studies on the relation between economic growth and national material throughput reveal three patterns: (1) ‘‘No decoupling;’’ i.e., material throughput increased faster or as fast as GDP, as was the case for Greece in the past two decades (see Eurostat, 2002) (2) ‘‘Relative decoupling,’’ a situation where the amount of material or energy needed to produce $1 of GDP declines over time – this be observed in many countries (see Eurostat, 2002; Fischer- Kowalski and Amann, 2001; Schandl et al., 1999) and (3)‘‘Absolute decoupling’’ in the sense that the aggregate materials and energy throughput of an economy declines over time while GDP continues to grow has taken place in a few industrial economies such as Germany or The Netherlands (Eurostat, 2002) although in this (and the other cases) the trade patterns must be taken into account. For instance, production of material-intensive raw materials and products can be outsourced through trade.

References

Eurostat, 2002. Material use in the European Union 1980–2000: Indicators and analysis. Luxembourg, Eurostat, Office for Official Publications of the European Communities.

Haberl, H., M. Fischer-Kowalski, F. Krausmann, H. Weisz, V. Winiwarter (2004): Progress towards sustainability? What the conceptual framework of material and energy flow accounting (MEFA) can offer. *Land Use Policy* 21(3), pp. 199-213.

Schandl, H., Hüttler, W., Payer, H. (1999): Delinking of economic growth and materials turnover. *Innovation—The European Journal of Social Sciences* 12 (1), pp. 31–45.

Fischer-Kowalski, M., Amann, C. (2001): Beyond IPAT and Kuznets curves: globalization as a vital factor in analyzing the environmental impact of socio-economic metabolism. *Population and Environment* 23 (1), pp. 7–47.

Fischer-Kowalski, M., Haberl, H. (1998): Sustainable development: socio-economic metabolism and colonization of nature. *International Social Science Journal* 50 (4), 573–587(1), pp. 1–8.

20. Degrowth

Concept and aims

The concept of degrowth has been described as “an equitable downscaling of production and consumption that increases human well-being and enhances ecological conditions at the local and global level, in the short and long term. The paradigmatic propositions of degrowth are that economic growth is not sustainable and that human progress without economic growth is possible.” (Schneider et al. 2010). Degrowth is not a precisely defined term, but is deliberately ambiguous, a sort

of a ‘bombshell’ word to trigger controversy and debate on the “religion of growth”. Advocates of degrowth want to part with the obsessive desire for growth. “Only mad men and economists believe that infinite growth is possible in a finite world”, is a quote attributed to Kenneth Boulding. This critique of the standard economic system on the one hand, and awareness of the social and ecological issues, on the other hand, lead logically to the necessary degrowth of the economy.

Origins of the “awkward term”

Décroissance was used in 1979 by J. Grinevald to translate some articles by Nicholas Georgescu-Roegen’s in a book entitled “Demain la decroissance” (tomorrow, degrowth). The newspaper "La Décroissance” first published in March 2004 then launched the term publicly in France. *Entropia*, an academic journal on themes linked to ‘la décroissance’ has been in press since 2006. In April 2008, an international conference in Paris focused on ‘economic degrowth for ecological sustainability and social equity’. On this occasion, ‘décroissance’ was translated for the English speaking audience as ‘degrowth’, and a second conference on socially sustainable economic degrowth was held in Barcelona in March 2010 (www.degrowth.eu). Proponents of the concept warn very expllicitly that the term should not be confused with ‘recession’, which implies an involuntary process.

History

Critiques of growth began to be vocalised in the environmental and counterculture movements of the 60’s and 70’s. Critiques of industrialisation and marketisation are of course even older, but these took further shape with the oil crisis of 1973. "The Limits to Growth", a report from the Club of Rome was published in 1972. Other works critical of environmental limitations of the economic system were published in the 1970’s: Ivan Illich, Barry Commoner, and André Gorz, are well known authors of that decade. Nicholas Georgescu-Roegen embedded theoretical economics in ecological constraints, the British economist EF Schumacher advocated more local and less technological and technocratic solutions in his book "Small is beautiful", Ivan Illich searched for less alienating and more emancipatory institutions and technologies, and Herman Daly promoted the steady-state. In India, Kumarappa, a Gandhian economist, had published the book “Economics of Permanence” in the 1940s, written in prison.

Essentially five different and overlapping sources can be identified as having driven the conception and development of Degrowth:

1. Ecological economics / bioeconomics: Based on a critique of the market and on established principles of physics and ecology, the limits of ecosystems (‘carrying capacity’) and their resilience are emphasized together with the finite nature of certain resources. There are absolute limits to the scale of global production and consumption, and to the scale national economies can attain without imposing environmental and social costs on others elsewhere or future generations. Degrowth

is needed to prevent depletion of resources and overloading of sinks, and to preserve biodiversity.

2. Ecologists / environmentalists. Ecology implies the study of ecosystems and respect for the diversity of life found in ecosystems. The decline of biodiversity is thus a major issue. The indicator HANPP is relevant in this respect. Economic growth and population growth are pressures on biodiversity.

3. Cultural diversity / post-development. Anthropology and development studies have shown that the idea of development has been imposed as universal by western culture. Growth and unbalanced exchanges between North and South mean that (see ecologically unequal exchange) the world's wealthiest nations are using more than their legitimate share of global environmental resources, and as a result are effectively reducing the environmental space available to poorer nations, and imposing adverse environmental impacts on them. Serge Latouche is a prominent spokesperson of this critique of westernization of the cultures.

4. Democracy / critical politics. Proponents of degrowth insist that the transition to sustainable life patterns has to be democratic, resulting from a collective choice. This leads to a critique of institutions of representative democracy, and the close links between policymakers, orthodox economists and businessmen. Vincent Cheney analyses the weight of commodification on political ideology and practices, joining the ecological economics critique of "chrematistics" and the defence of "oikonomia".

5. Spirituality / voluntary simplicity. This refers to what some call 'the meaning of life' and movements emphasizing spirituality, non-violence, art or voluntary simplicity. Advocates assess consumption as a social process of an ever-growing demand for new satisfactors of needs that are often meaningless. Critiques are aimed at advertising, seen as the paragon of our industrialised societies, with an 'inner revolution' and a more spiritual life called for, based on personal and relations (conviviality) rather than objects.

The birth of a movement

Degrowth has now become a political, economic, and social movement based on environmentalist, anti-consumerist and anti-capitalist ideas. It can be described as a galaxy of people willing to experiment with or advocate alternative ways of co-existing with the goal of maximising happiness and well-being through non-consumptive means: reducing work time, consuming less, while devoting more time to art, music, family, culture and community. These experiments occur at three levels: individual, collective / communal, and political. At the individual level, degrowth is achieved by voluntary simplicity. Conviviality and slowness are endorsed through collective projects (e.g. slow food, transition towns). Proposals for global solutions involve the relocalisation of economic activities in order to end humanity's dependence on fossil fuels and reduce its ecological imprint.

Key arguments

In line with this objection to growth, several critiques are directed at the main economic indicator, GDP (Gross Domestic Product). Growth in GDP results from an increase in production, consumption and investment in the pursuit of economic surplus, inevitably leading to increased use of materials, energy and land. Confronted with an environmentally, socially and culturally destructive crisis of over-accumulation, it is becoming apparent that economic growth is the problem rather than the solution. Degrowth thus champions changing the benchmark from GDP to a measure of sustainable and equitable well-being.

Degrowth also opposes the current notion of sustainable development because while sustainable development aims to address environmental concerns, it does so with the goal of promoting economic growth, growth which has failed to improve the lives of many people and lead to environmental degradation. Despite improvements in the ecological efficiency of the production and consumption of goods and services, global economic growth has resulted in increased extraction of natural resources and increased waste and emissions. Global economic growth has not succeeded in eliminating poverty, due to unequal exchange in trade and financial markets, which has increased inequality between countries. While sustainable development relies on solutions that are primarily technological or managerial, Degrowth in contrast questions the accumulation of capital and commodities through production and consumption.

Critical questions

Degrowth proponents aim to reduce the global ecological footprint to a sustainable level, through decreased and different production and consumption in the “global North”, and increased and different production/consumption in the “global South”. However, while there are clear objectives in the way of a need for a transition towards a just, participatory, and ecologically sustainable society, it is unclear how this transition can be organised and managed. Whether degrowth can be achieved through individual, local or networked activities remains an open question, as does how institutions could or should be transformed to support sustainable degrowth. Many partisans of Degrowth see it as leading in due course to a Steady-State Economy as proposed by Herman Daly in 1973.

References

Institut d'études économiques et sociales pour la décroissance soutenable: http://decroissance.org/

Declaration of the Conference on Economic Degrowth for Ecological Sustainability and Social Equity, Paris, 18-19 April 2008: http://events.it-sudparis.eu/degrowthconference/Declaration%20on%20Degrowth%20EN.pdf

Schneider, Francois, Giorgos Kallis and Joan Martinez-Alier (2010), 'Crisis or opportunity? Economic degrowth for social equity and ecological sustainability', *Journal of Cleaner Production*, vol. 18, Pages 511-518.

Websites:

http://www.degrowth.net/

http://degrowthpedia.org/

21. Depopulation

Definition and process

Depopulation refers to a process in which the population density of an area decreases steadily over time. Depopulation has affected rural areas almost exclusively. Increased human population is certainly a threat to environmental sustainability, but local phenomena of rural depopulation may be seen also as threats to local environmental sustainability.

Rural depopulation is an effect of the general phenomenon of rural exodus caused by modern economic growth. During industrialization, cities expand rapidly, concentrating the location first of industry and then services. This expansion draws labour in from rural areas, where at the same time, the mechanization of farm activities encourage further rural-to-urban migration. Rural depopulation is a process affecting regions where the rural exodus outstrips natural growth, reducing the total number of inhabitants to a critical level and causing an aging of demographic structures.

Impacts

This process of depopulation provokes a range of environmental impacts. In contrast to Malthusian doctrine and related predictions of the negative pressure exerted by the increase of Human Appropriation of Net Primary Product (HANPP) on biodiversity, depopulation and migration processes can actually increase environmental pressures on biodiverse agricultural production through increased soil erosion and invasions by pests and weeds, leading to reduction of biodiversity. For example, as people leave an area, one dominant habitat (usually secondary forest or savannah) comes to take over from the diverse mosaic of human-maintained landscapes.This 'ecological homogenisation' can lead to a decrease in biodiversity at a local level. Other ecological impacts include soil degradation resulting from inadequate terrace maintenance in mountainous areas, as is the case across large swathes of Mediterranean and Southeast Europe. Abandonment of agricultural lands also affects remaining agriculture in that as plots are abandoned, adjacent plots can suffer increased invasions by pests and weeds, and receive less sunlight due to shading from regenerated forests.

Related phenomenon

Another phenomenon that may be related to depopulation is increased frequency of forest fires as in depopulated regions in the Mediterranean and South Eastern Europe. Whether this increase is related to depopulation is under research, but depopulation does lead to increased fuel load in forests and a lack of feeling of responsibility for forest protection by the local population as well as a lack of people to detect and suppress fires early. Rural depopulation also transforms territory, sometimes leading to a loss of valued cultural landscapes. Neverthless, the rural-urban shift may have positive implications for consumption patterns. Dense urban areas offer relatively more integrated service provision such as waste collection and collective transport.

In order to address these multiple, related impacts, research into the causes of and remedies for rural population should be tied into an exploration of how rural economies can be bolstered through sustainable resource management to stem population drain.

References:

Jacob, Aerin, L., Vaccaro, Ismael, Hartter, Joel, Chapmans, Colin, A. 2008, Integrating landscapes that have experienced rural depopulation and ecological homogenization into tropical conservation planning.*Tropical Conservation Science* Vol.1(4):307-320,

MacDonald et al. 2000. Agricultural abandonment in mountain areas of Europe: environmental consequences and policy response, *J. Environ. Manag.* 59, pp. 47–69

22. DPSIR

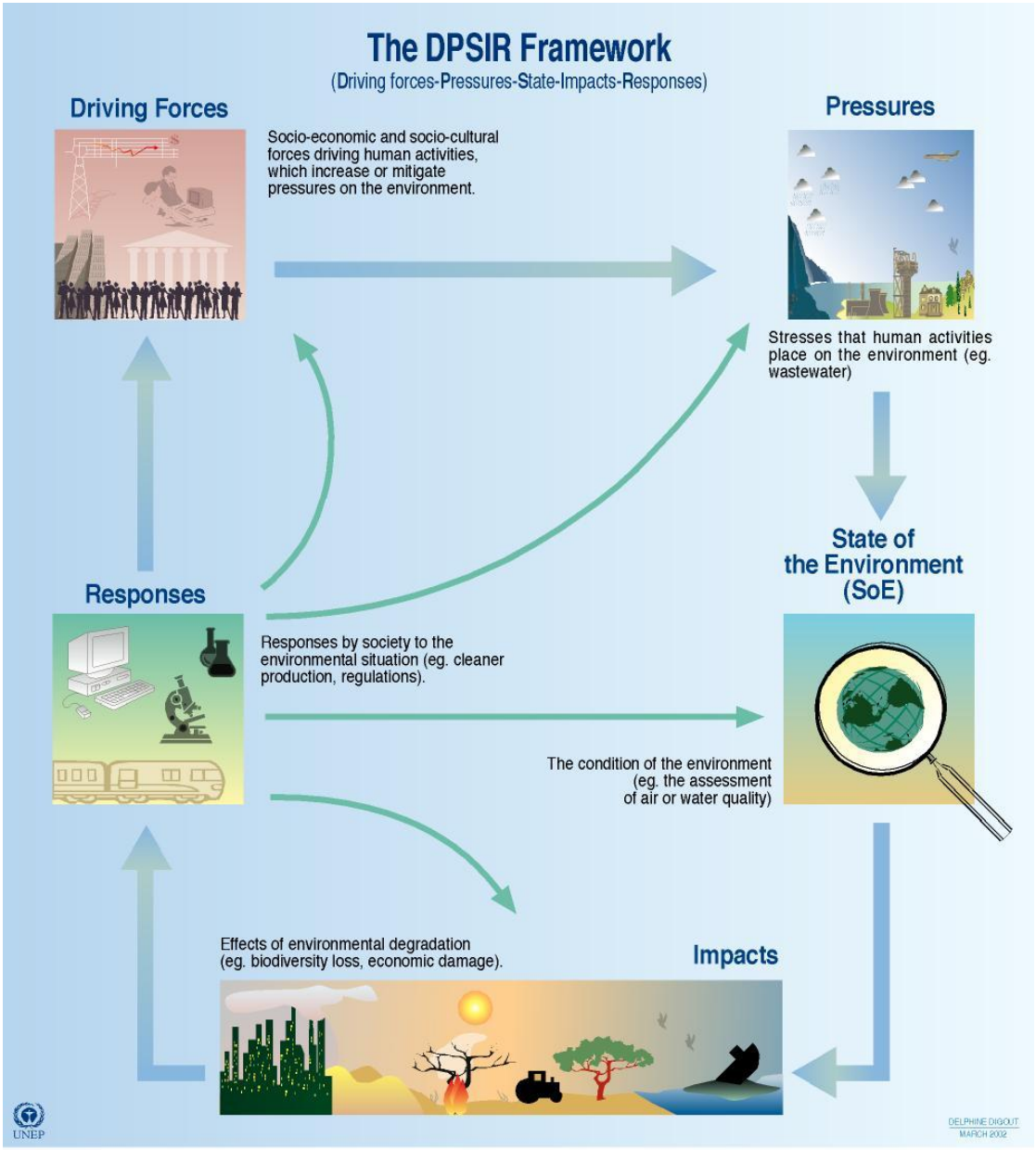
Concept origins

DPSIR is a causal framework developed by the European Environmental Agency (EEA) to describe and communicate the interactions between society and the environment. Based on the PSR (Pressures/State/Response) model proposed by the OECD, it has been applied to the organisation of systems of indicators and statistics in relation to policy aims (e.g. EEA, EUROSTAT).

Elements

(a) **Driving Forces** are the changes in the social, economic and institutional system that directly and indirectly trigger pressures on the environmental state. The EEA defines them as “the social, demographic and economic developments in societies and the corresponding changes in lifestyles, overall levels of consumption and production patterns” (EEA 2007). A classification of four non-hierarchical but interacting levels of driving forces influencing the structure and relation between the social, economic, political and environmental systems has been proposed

DPSIR Model



Source : Global International Water Assessment (GIWA), 2001; European Environment Agency (EEA), Copenhagen.

Figure 1: Source: Global International Waters Assessment (GIWA), 2001; European Environment Agency (EEA); Copenhagen.
(Delphine Digout, UNEP/GRID-Arendal).

(Rodríguez-Labajos et al., 2009). From this approach, the “primary driving forces” are the socio-economic activities directly linked with pressures (e.g. industry, tourism) at the management level. “Secondary driving forces” are found at the policy level (e.g. waste policy, laws). In the long term and with a broader spatial sphere of influence there is the level of “tertiary driving forces”, ideology and lifestyle (e.g.

media, consumption patterns). Finally, the “base driving forces” include fundamental trends (demographic or cultural), that are only influenced by social decisions in the long term (e.g. climate change, demography).

(b) **Pressures** are the anthropogenic factors inducing environmental change (Impacts). They are defined by the EEA as “developments in release of substances (emissions), physical and biological agents, the use of resources and the use of land by human activities”, although different approaches to its definition can be found in the literature.

(c) **State** may refer to a natural system alone or to both a natural and socio-economic system. According to the focus, indicators of State can be very different. State can refer to a wide range of features, from the qualitative and the quantitative characteristics of ecosystems, the quantity and quality of resources, living conditions for humans, exposure to the effects of Pressures on humans, to even larger socio-economic issues. The combination of the current State and the existing Pressures explains Impacts.

(d) **Impacts** are changes in environmental functions affecting social, economic and environmental dimensions, which are caused by changes in the State of the system. Impacts can include changes in environmental functions such as resource access, water and air quality, soil fertility, health, or social cohesion (Maxims et al 2009). These Impacts trigger Responses.

(e) **Responses** are the policy actions which are directly or indirectly triggered by the perception of Impacts and which attempt to prevent, eliminate, compensate or reduce their consequences. Responses can come from different levels of the society, such as groups of individuals, governments or non-governmental sectors. These Responses can in turn influence trends in the Driving Forces, Pressures, State and Impacts.

References:

European Environment Agency (EEA), 2007. Halting the loss of biodiversity by 2010: proposal for a first set of indicators to monitor progress in Europe, *EEA Technical Report no. 11/2007*, European Environment Agency, Copenhagen 186 pp.

Maxims L. Spangenberg J. and O'Connor, M. 2009. The DPSIR framework for Biodiversity Assessment. Ecological Economics Vol 69, Issue 1, P. 12-23.

Rodríguez-Labajos, B., Binimelis, R. and Monterroso I. 2009. The DPSIR framework for Biodiversity Assessment. Ecological Economics Vol 69, Issue 1, P.63-75

Websites:

http://www.unep.org/dewa/assessments/ecosystems/water/vitalwater/12.htm#13

23. Eco-Efficiency

Definition

The concept of eco-efficiency was introduced by the World Business Council for Sustainable Development (WBCSD www.wbcsd.org) in the book 'Changing Course', published in preparation for business sector participation in the 1992 Rio Earth Summit.

This concept describes a vision for the production of economically valuable goods and services while reducing the ecological impacts of production. According to the WBCSD, "eco-efficiency is achieved by the delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the life-cycle to a level at least in line with the Earth's estimated carrying capacity." In short, it is concerned with creating more value with less impact (i.e. using fewer resources and creating less waste).

Eco-efficiency is a management philosophy, which encourages business to search for environmental improvements that yield parallel economic benefits. It focuses on business opportunities and allows companies to become more environmentally responsible and more profitable.

Core Elements

According to the WBCSD the fundamental elements of eco-efficiency are:

- A reduction in the material intensity of goods or services;
- A reduction in the energy intensity of goods or services;
- Reduced dispersion of toxic materials;
- Improved recyclability;
- Maximum use of renewable resources;
- Greater durability of products;
- Increased service intensity of goods and services.

The reduction in ecological impacts translates into an increase in resource productivity, which in turn can create a competitive advantage for businesses. At a macro level, eco-efficiency is seen as a way to decouple economic growth from its impacts in ecological systems. Progress in eco-efficiency trends are studied by a discipline called Industrial Ecology.

Limitations

Many authors claim that the optimistic view regarding the role of technological win-win solutions will not represent a sufficient response to the challenge of sustainability. Issues such as the Jevons' Paradox (or rebound effect), distribution of the benefits of technological improvements, life styles, production and consumption patterns and empowerment require important changes in social and political organization and governance that go far beyond the technical fixes underlying the concept of eco-efficiency.

References

DeSimone, L., F. Popoff with the WBCSD, 1997. Eco-efficiency. The Business Link to Sustainable Development. The MIT Press, Cambridge, Ma.

Schmidheiny, S., with the Business Council for Sustainable Development, 1992. Changing Course. A Global Business Perspective on Development and the Environment. The MIT Press, Cambridge, Ma.

World Business Council for Sustainable Development (WBCSD) www.wbcsd.org

24. Ecological Debt

Concept origins

It has been understood that the present societal use of resources is not sustainable in the long run, mainly because the costs associated with unsustainable activities do not affect those that carry out these activities. The notion of ecological debt focuses on this disequilibrium: the majority who over-exploit the global commons (rich countries) owe an ecological debt to those in possession of resources (poor countries). The poor are not using even a small portion of their legitimate share of the global commons, while the North has been permitted to pollute over the last century without limits and at little cost to build its economy and industrial base cheaply and rapidly.

The first discussions on ecological debt concept took place around 1990, largely thanks to inputs from Latin American NGOs, and then followed by Friends of the Earth International. In 1992, during the Rio Summit, the creation of a Debt Treaty was proposed which introduced the notion of an ecological debt in contraposition to the external debt. Under this proposal, the sizable ecological debts of industrialized countries would be grounds for a compensatory transfer scheme aimed at eliminating, the external debt of many developing countries.

While no official definition of ecological debt exists, the concept addresses pollution, 'theft' of resources and disproportionate use of the environment. Accion Ecologica defined it in 1999 as "the debt accumulated by northern industrial countries toward

third world countries on account of resource plundering and use of environmental space to deposit wastes". In 2009, the Centre for Sustainable Development (CDO) at Ghent University proposed as a working definition: (1) the ecological damage caused over time by a country in other countries or to ecosystems beyond national jurisdiction through its production and consumption patterns; (2) the exploitation or use of ecosystems (and its goods and services) over time by a country at the expense of the equitable rights to these ecosystems by other countries.

Application

The ecological debt concept focuses on the lack of political power of poor regions and countries. The debt arises from: (1) exports of raw materials and other products from relatively poor countries or regions being sold at prices which do not include compensation for local or global externalities; (2) rich countries or regions making disproportionate use of environmental space or services without payment (for instance, to dump carbon dioxide).

Ecological debt usually designates a public debt a country has toward other countries (foreign debt) but can also be used to calculate a debt (or liability) from a company (private debt) or a debt a nation has toward future generations (generational debt).

Difficult questions

The notion of ecological debt raises hard political and ethical questions. Should poorer countries get a greater share of resource consumption in the future to compensate? Should poor communities not have the same chance to consume that richer ones have had? Is it just to ask current generations in rich countries to pay for the sins of their fathers? At what period should we start calculating the debt? It might be considered as an injustice to the present generation that we should pay for the debts of past generations, but if we do not take responsibility for the debt of past generations, who should?

Regarding its methodology, the main objection to the notion of ecological debt is that it implies monetization of nature's services, which is not a matter of consensus amongst researchers or campaigners. The method proposed to calculate ecological debt requires money estimates of the value of the environment, which are difficult to make, for various reasons (uncertainties, incomparable impacts, limited substitutability between natural and human-made capital, arbitrariness of the discount rate, ethics barriers). Theoretically it may be possible to put a money value on the ecological debt by calculating the value of the environmental and social externalities associated with historic resource extraction and adding an estimated value for the share of global pollution problems borne by poor countries as the result of higher consumption levels in rich ones. This includes efforts to value the external costs associated with climate change. However, such monetary accounts (Goemmine and Paredis, 2009, Srinivasan et al, 2008) are useful to Ecological Debt campaigners from civil society.

Toward environmental justice

In conclusion, the ecological debt concept casts a new light on our understanding of "sustainable development", not just by adding a historical dimension but by bringing power and justice to centre-stage, to reveal control over resources and pollution burdens as an issue of power relations. The point is not to exchange external debt for protection of nature (ex: debt for nature swaps) but to emphasise that the external debt from South to North has already been paid on account of the ecological debt the North owes to the South, and to stop the ecological debt from increasing any further. The concept is still in a developing phase, with its definition, methodology and political implications under discussion among scientists and campaigners. Nevertheless, it is a concept with the potential to rebalance global forces, to implement sustainability and to achieve environmental justice.

References

Goemmine, G., Paredis, E. 2009. The concept of ecological debt: some steps towards an enriched sustainability paradigm, *Environment, Development and Sustainability* (in press).

Martinez-Alier J. (2002) *The Environmentalism of the Poor. A study of ecological conflicts and valuation*. Edward Elgar Publishing, Northampton, 332p.

McLaren D. (2006) *Environmental space, equity and the ecological debt*. In Just Sustainabilities. Development in an unequal world. Ed. By Agyeman J., Bullard RD, Evans B. Earthscan, London, 347p.

Simms A. (2005) Ecological debt: the health of the planet and the wealth of nations. Pluto press, Northampton, 206p.

Srinivasan, U.T., Carey, S.P., Hallsteind, E., Higgins, P.A.T., Kerr, A.C., Koteen, L E., Smithd, A.B., Watson, R., Harte, J., Norgaard, R.B. 2008. The debt of nations and the distribution of ecological impacts from human activities. Proceedings of the National Academy of Sciences of the USA, 105, 1773–1786.

Websites

http://www.worldrevolution.org/guide/ecologicaldebt

http://www.ecologicaldebt.org/

http://www.enredeurope.org/principal.htm

http://www.foei.org/en/publications/ecodebt

25. Ecological Economics

Broad definition

Ecological economics has been compared to human ecology (Martinez-Alier, 1998), which instead of resorting to a single unit of account – money – includes the biophysical aspects of economic processes. Ecological economists look at economic processes in a way similar to the way ecologists examine ecosystems: their approach is fundamentally metabolic, meaning that the economy is seen as a subsystem of a larger finite global ecosystem. More specifically, the economy is regarded as open to the entry/exit of materials and energy, for instance in the form of raw materials (entry) and pollution (exit), and economic processes are regarded as entropic and thus irreversible. It is in this sense that ecological economics can be seen not as a branch of economics but rather as similar to "human ecology" or to "oikonomia", to use Aristotle's term. Aristotle famously distinguished "oikonomia", the art and science of the material provision of the "oikos" or home, from "chrematistics" which we now call economics and which is the study of market price formation for the purpose of making money.

A note on paradigm shift

Ecological economics has evolved in a different paradigm than that of conventional (neoclassical) economics, which is still largely based on mechanistic principles. Following from this, neoclassical economics remains for the most part ahistorical, universalist in its explanatory ambitions, and specialised in abstract mathematical formalism. Its portrayal of human beings as utility-maximizing agents whose aggregated behaviours lead under certain conditions to equilibrium is also rooted in the mechanistic paradigm, the ideological consequences of which are the promotion of self-regulated markets, economic growth and "technical progress". Quite the opposite, ecological economics was founded on an epistemological revolution stimulated by the birth of thermodynamics, and is associated with notions such as entropy, order parameters, complexity, irreversibility and evolution. This approach represents a clear departure from the mechanistic paradigm with far-reaching implications. Notably it implies the uncomfortable acknowledgment that scientists can only work with system-dependent and context-dependent definitions of entities (Georgescu-Roegen, 1971). Reductionist models and their predictions lose much of their relevance, the corresponding image of human being becomes bio-psycho-socio-cultural, and the ideological implications are markedly different.

Some key concepts

The central concept of ecological economics is *sustainability*, which is approached both qualitatively and empirically, with particular attention paid to spatial scales (ranging from local to global) and biophysical indicators (see below). On the contrary, standard environmental economics usually regards sustainable development as being synonymous with sustainable growth, measured in monetary indicators and

studied with general models that avoid any reference to historical and spatial aspects.

Ecological economics emphasizes the incommensurability of values (i.e. different value systems cannot be expressed in the same units). It champions therefore multi-criteria evaluation methods based on explicit value premises and on different socio-cultural and biophysical indicators. Examples of the latter are HANPP (human appropriation of net primary production), the GDP of the poor, the material intensity of consumption based on the study of material flows, EROI (energy return on energy input), MIPS (material input per unit service), the ecological footprint, and so on. These indicators are measured in units which are different to conventional economic accounting. How should a situation be judged in which, for instance, HANPP, EROI and GDP generate contradicting results? Ecological economists believe that it is not necessary to reach an encompassing "super-value" (as implied by the notion of commensurability), but rather, the goal is to reach reasonable judgements by employing a multi-criteria evaluation or an integrated assessment.

Ecological economics generally assumes a longer time horizon than environmental economics and therefore it disputes the notion that the future should be discounted). It pays more attention to cause-effect chains, interactions and feedback between natural and human-economic systems. The concept of "co-evolution" is in this respect relevant, reflecting a mutual influence of economic and environmental systems. Ecological economists see systems, including markets, as adaptive rather than optimal in the neoclassical sense. In this sense, ecological economics inherently entails an evolutionary dimension, taking the view that markets cannot sufficiently meet the needs of the poor, nor can they produce the "optimal" technologies and production activities necessary from a long-term, ecologically sound perspective.

Ecological economics is not a "technocratic" or "scientistic" project. On the contrary, as explained by Funtowicz, Ravetz and others, in many current problems of importance and urgency, where values are in dispute and uncertainties are high, "certified experts" are often challenged by citizens from environmental groups – for instance, "popular epidemiology" activists, opponents to nuclear energy or GMOs, or proponents of the practical knowledge of indigenous and peasant populations. This is "post-normal science", leading toward democratic/participatory methods of conflict resolution and decision-making, notions which are dear to ecological economists.

Final remarks

Ecological economics is based on methodological pluralism. It therefore does not follow the reductionist road but rather a kind of "orchestration of the sciences" (Otto Neurath), acknowledging and trying to reconcile the contradictions arising between the different disciplines which deal with issues of sustainability (Martinez-Alier, 1998). For instance, how can we take into account the opposite viewpoints of

conventional agricultural economics (technical progress, growth of productivity) and of agro-ecology (loss of biodiversity, decreased energy efficiency)? The image of the "orchestration of the sciences" fits well with the ideas of "co-evolution" and of "value pluralism" implying the study of the human dimensions of ecological change and therefore the study of human environmental perceptions. Ecological economics as an "orchestration of the sciences" also highlights the limits of the authoritative judgements of any particular expert in a particular discipline. It is a field that has evolved in response to the nature of existing problems, to their interdisciplinary aspects, to their urgency, and to their uncertainty, and one that requires the democratisation of science as a precondition for their resolution.

References

Funtowicz, S. & Ravetz, J., 1994. The worth of a songbird: ecological economics as a post-normal science. *Ecological Economics*, 10: 189-96.

Martinez-Alier, J., 1998. *Ecological economics as human ecology*. Lanzarote: Fundacion Cesar Manrique.

Georgescu-Roegen, N., 1971. *The entropy law and the economic process*. Cambridge, MA: Harvard University Press.

26. Ecological Footprint

Introduction and definition

Conceived in the early nineties by William Rees and Mathis Wackernagel at the University of British Columbia, the ecological footprint is now widely used by scientists, businesses, governments, agencies, civil society organizations and individuals, working to monitor ecological resource use and advance sustainability.

The ecological footprint is a measure of human demand on the Earth's ecosystems. It compares human demand on nature with Earth's ecological capacity to regenerate resources and provide services. The ecological footprint represents the amount of biologically productive land and water area needed to produce the resources an individual, population or activity consumes and to absorb and render harmless the corresponding waste, given prevailing technology and resource management practices. This area can then be compared with the amount of productive area that is available to generate these resources and to absorb the waste.

Footprint methodology

Ecological footprint analysis calculates the combined demand for ecological resources, expressed as the global average area needed to support a specific human activity. Demand for resource production and waste assimilation are translated into a common area unit by dividing the total amount of a resource

consumed by the yield per hectare, or dividing the waste emitted by the absorptive capacity per hectare. Yields are calculated based on various international statistics, primarily from the United Nations Food and Agriculture Organization.

An important component in footprint calculations, particularly for rich countries, is inclusion of the amount of land with new vegetation that would hypotheticallly take up carbon dioxide emissions (in contrast to land actually used for food or timber). In fact, a large part of human-produced carbon dioxide emissions are not taken up through photoshynthesis on land but are taken up by oceans, with about half accumulating in the atmosphere causing the increased greenhouse effect.

In ecological footprint calculations, land and water area is scaled according to its biological productivity. This scaling makes it possible to compare ecosystems with differing bioproductivity and in different areas of the world in the same unit, a global hectare (gha). Six main land use types are considered in ecological footprint accounts: cropland, grazing land, fishing ground, forests for timber and fuelwood, forests for carbon dioxide uptake, and built-up land. For all land use types there is a demand on the area, as well as a supply of such an area.

Usually the ecological footprint of a population is calculated from a consumption perspective, i.e., it measures the land demanded by the final consumption of the residents of the country. This includes household consumption as well as their collective consumption of items, such as schools, roads, etc. Most ecological footprint studies and published reports refer to this perspective. However, the ecological footprint can also be calculated based on production. In this case, a country's primary production ecological footprint is the sum of the footprints for all resources harvested and all waste generated within the country's geographical borders. The difference between the estimates provided by these two perspectives corresponds to the balance between imports and exports.

Footprint results and use

Metrics such as the ecological footprint are a useful tool in the sustainability debate, since they allow us to give an attractive representation (in terms of hectares), easy to grasp, of the present use of natural resources.

For example, using an ecological footprint analysis, Wackernagel and his associates estimate how many planet Earths it would take to support humanity if everybody lived a given lifestyle. According to the Ecological Footprint Atlas 2009 (available at http://www.footprintnetwork.org/images/uploads/Ecological_Footprint_Atlas_2009.pdf), in 2006, humanity's total ecological footprint was 17.1 billion global hectares (gha); with world population at 6.6 billion people, the average person's footprint was 2.6 global hectares. The area of biologically productive land and water on Earth was estimated at approximately 11.9 billion hectares, or 1.8 gha per person. This overshoot of approximately 40 percent means that in 2006 humanity used the equivalent of 1.4 Earths to support its consumption. This is of course a metaphor

since there is only one planet Earth. The result is largely due to the accounts of hypothetical land for taking up carbon dioxide emissions.

Global comparisons also clearly show the inequalities of resource use worldwide. Per capita ecological footprint is a means of comparing consumption and lifestyles. While an average inhabitant of Bangladesh or Nepal consumes 0.5 gha per year (in

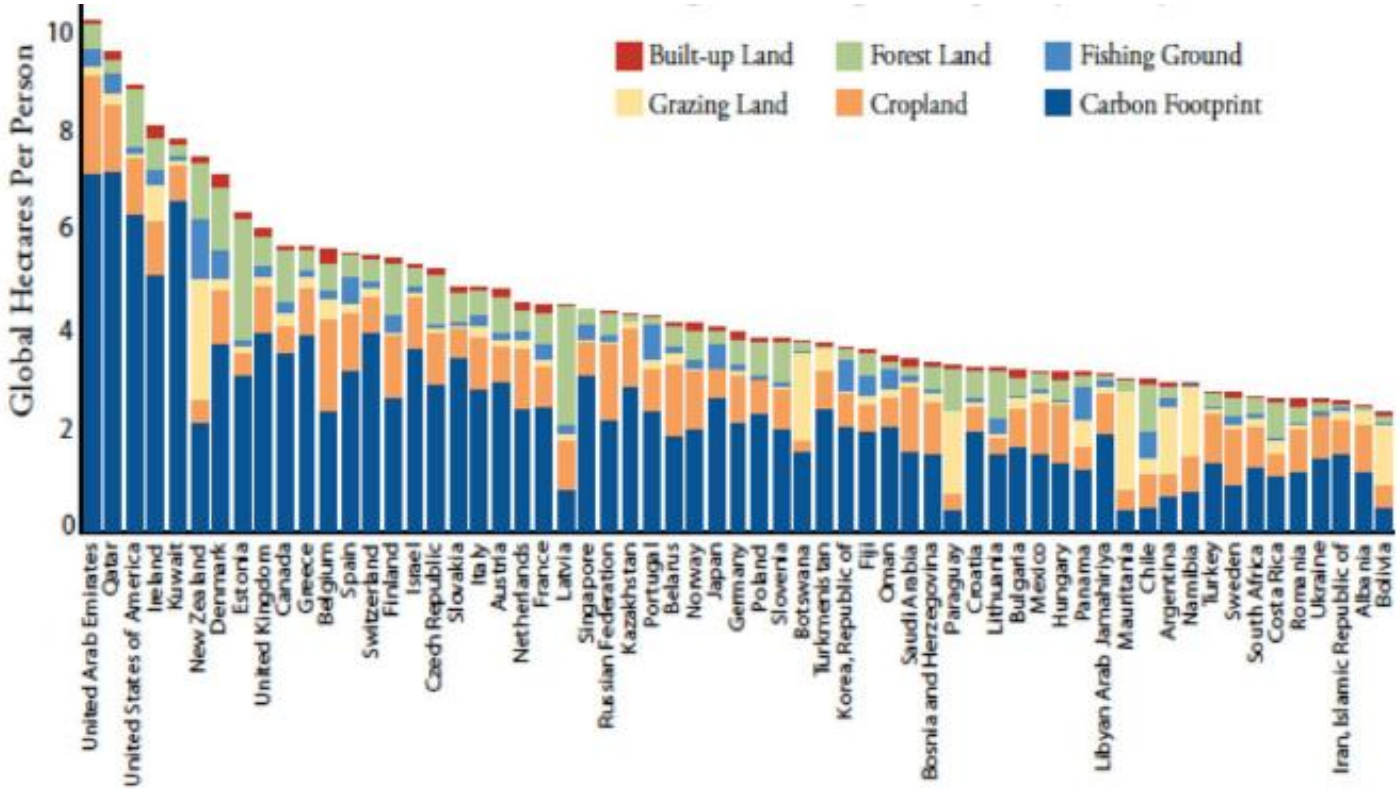


Figure 1: Ecological footprint by country
(Source: Ecological Footprint Atlas 2009)

2006), an average Chinese takes 1.8 gha and an average American 9.0 gha (**Figure** 1).

Ecological footprinting is now widely used around the globe as an indicator of environmental sustainability. Footprints can inform policy by examining to what extent a nation or a region or a city uses more (or less) than is available within its territory, or to what extent the nation's lifestyle would be replicable worldwide. It can also be a useful tool to educate people about carrying capacity and over-consumption, with the aim of influencing individual behavior. Ecological footprints may be used to explore the sustainability of individual lifestyles, goods and services, organizations, industry sectors, neighborhoods, cities, regions and nations. A number of NGO websites allow estimation of one's ecological footprint (http://www.footprintnetwork.org/en/index.php/GFN/page/personal_footprint/ or http://www.myfootprint.org/).

Problems and concerns

The Global Footprint Network (www.footprintstandards.org.) developed the first set of ecological footprint standards in a facilitated public process in 2006, detailing communication and calculation procedures, and continues to work toward an accepted standardized methodology.

The ecological footprint is an intuitively appealing indicator (easy to communicate and understand with a strong conservation message). The indicator is most effective, meaningful and robust at aggregate levels (national and above), but concerns have been raised regarding the use of the ecological footprint as a sustainability indicator. Many criticisms are related to the lack of consideration of aspects such as land degradation, biodiversity loss, toxicity to humans and ecosystems, etc. Also issues such as the distinction between intensive and extensive agriculture, accounting for multifunctionality in ecosystems and neglecting resource scarcity have been raised. It should be acknowledged that the use of natural resources entails a large number of different environmental impacts. One single indicator is unable to illustrate the complexity of these impacts and their interrelations, in particular, regarding burden shifting between different types of impacts. Moreover, two important issues are not properly addressed in EF calculations. First, how much land should be devoted to the maintenance of other "wild" species? Second, why to express the issue of excessive carbon dioxide emissions in terms of hypothetical land required to absorb it?

Therefore, sustainability assessment should not rely on the use of a single tool or indicator, but use a set of indicators covering different perspectives and dimensions of sustainability. See for instance the WWF's Living Planet Report (http://www.panda.org/about_our_earth/all_publications/living_planet_report/lpr_2008/). Ecological footprints may be a powerful and useful tool in this context.

References

Best, A., S. Giljum, C. Simmons, D. Blobel, K. Lewis, M. Hammer, S. Cavalieri, S. Lutter and C. Maguire. 2008. Potential of the Ecological Footprint for monitoring environmental impacts from natural resource use: Analysis of the potential of the Ecological Footprint and related assessment tools for use in the EU's Thematic Strategy on the Sustainable Use of Natural Resources. Report to the European Commission, DG Environment.

Ewing B., S. Goldfinger, A. Oursler, A. Reed, D. Moore, and M. Wackernagel. 2009. The Ecological Footprint Atlas 2009. Oakland: Global Footprint Network.

van den Bergh, J. and H. Verbruggen, 1999, Spatial sustainability, trade and indicators: an evaluation of the 'ecological footprint', *Ecological Economics*, Vol. 29(1): 63-74.

Wackernagel, M. and W. Rees. 1996. *Our Ecological Footprint: Reducing Human*

Impact on the Earth. New Society Publishers.

Wackernagel, M., N., Schulz, D. Deumling,, A. Callejas Linares, M. Jenkins, V. Kapos, C. Monfreda, J. Loh, N. Myers, R. Norgaard, and J. Randers. 2002. Tracking the ecological overshoot of the human economy. Proceedings of the National Academy of Sciences, Vol. 99, Issue 14, pages 9266-9271, July 9, 2002.

Websites

www.ecologicalfootprint.com

www.footprintnetwork.org

www.rprogress.org/ecological_footprint/about_ecological_footprint.htm

27. Ecological Rucksacks and Hidden Flows

Definition

An ecological rucksack is defined as the total quantity (in kg) of natural material (M) that is disturbed in its natural setting, and thus considered the total input (I) in order to generate a product - counted from the cradle to the point when the product is ready for use - minus the weight (in kg) of the product itself (Schmidt-Bleek, 1993). The *rucksack factor* of materials *(MI)* is the sum total of natural materials utilised (kg) to make one kg of technical base (raw or starting) materials available (e.g. wood, iron etc.) (Schmidt-Bleek, 1998).

Five different rucksacks have been delineated by the Wuppertal Institute (see http://www.wupperinst.org/en/home/index.html) to describe the overall natural resource intensity of products. These correspond to the 5 environmental spheres of: water, air, soil, renewable biomass, and non-renewable (abiotic) materials (Schmidt – Bleek 1999).

On average, industrial products carry non - renewable rucksacks that are about 30 times their own weight. Only about 5 % of non-renewable natural material disturbed in the ecosphere typically ends up in a technically useful form. In the case of a PC, the ecological (abiotic) rucksack weighs at least 200 kg per kg of product. For base materials (such as iron, plastic or copper), MI values allow the comparison of technical starting materials regarding their resource intensities and thus allow the computation of the rucksack of products, so long as the material compositions of these products are known (Schmidt-Bleek, 1998). MI values (rucksack factors) for non-renewable resources of base materials are for example: round wood = 1.2, glass = 2, plastics = 2 – 7, steel = 7, paper = 15, aluminium = 85 , copper = 500, platinum

= 500 000. (Schmidt – Bleek, 1999)

Beyond Rucksacks

In its methodological guide, Eurostat (2001) introduced a new and extended terminology for distinguishing between different types of upstream material requirements, formerly lumped together as 'hidden flows' or 'ecological rucksacks'. Eurostat suggests making a distinction between 'used' and 'unused' extraction on the one hand and 'direct' and 'indirect' flows on the other hand. The distinction 'used' and 'unused' extraction refers to the boundary between an economic system and its natural environment and specifies what should be regarded as an 'input' from the environment to the economic system, i.e. what should be regarded as a raw material. Dredging material, excavation material, overburden from mining (the sterile material which has to be removed in order to get access to the gross ores) and unused by- products from biomass harvest are the main components of 'unused' extraction.

The distinction between 'direct' and 'indirect flows', on the other hand, refers to the boundary between a national economy relative to other national economies, i.e. to traded goods. All upstream material requirements for producing imported or exported commodities are denoted as 'indirect flows'. As goods in different stages of processing are traded, from basic commodities to final products, indirect flows consist of two fractions: The "raw material equivalents" represent used extraction, needed to produce traded goods. Unused raw materials represent the 'unused' part of indirect flows. As raw material equivalents represent used extraction, necessary for producing traded commodities, the quantification of raw material equivalents would allow for a standardization of physical foreign trade flows to the same economy-environment system boundary as applied in used domestic extraction (DE) (Weisz , 2006).

According to Weisz, "With such information, both a net trade balance in terms of raw materials and the raw material requirements of domestic final consumption could be calculated for a national economy." Further "a net trade balance in terms of raw materials is needed to investigate if, and to what extent, a country's domestic final consumption is indirectly dependent on raw materials from abroad" (Weisz, 2006). Weisz (2006) states that the "ecological rucksacks" or "hidden flows" approach, developed by the Wuppertal Institute may be appropriate for accounting for the unused extraction of a few basic commodities if regional specific coefficients (MI factors) are available, but cannot be applied to the much more complex estimation of raw material equivalents of all imported and exported goods. The reasons for this are that (1) the number of coefficients that would be needed is by far too large to be compiled in practice (2) LCA – type approaches such as this lack appropriate standards to guarantee the consistency and comparability of the accounts, in particular when aggregated to larger scales (3) Factors cannot account for the so called second and third round effects of the intermediate use and supply chains of the industrial production system. These intermediate flows have become extremely

large in highly industrialized economies (see Ayres et al. 2004).

References

Ayres, R. U., Ayres, L. W., and Warr, B. (2004): Is the US economy dematerializing? Main indicators and drivers. In: van den Bergh, J. C. J. M. and Janssen, M. A. (eds.): Economics of Industrial Ecology. Materials, Structural Change, and Spatial Scales. Cambridge, MA: MIT Press, pp. 57-93

Bringezu, S., Schutz, H., Steger, S., and Baudisch, J. (2004): International comparison of resource use and its relation to economic growth: The development of total material requirement, direct material inputs and hidden flows and the structure of TMR. In: *Ecological Economics* 51(1-2), pp. 97-124

Eurostat (2001): Economy-wide Material Flow Accounts and Derived Indicators. A methodological guide. Luxembourg: Eurostat, European Commission, Office for Official Publications of the European Communities

Schmidt-Bleek, F. (1999): The Factor 10/MIPS-Concept: Bridging Ecological, Economic, and Social Dimensions with Sustainability Indicators. ZEF Publication Series, Tokyo/Berlin.

Weisz, Helga (2006): Accounting for raw material equivalents of traded goods. Acomparison of input-output approaches in physical, monetary, and mixed units. Social Ecology Working Paper 87. Vienna.

Websites:

http://www.factor10-institute.org/index.html

http://www.wupperinst.org/Projekte/mipsonline

28. Ecologically Unequal Exchange

Background and Definition

It has long been mistakenly argued that developed nations are "dematerializing" their economies, that is, that citizens of these countries value more and more consumption of services over material products and therefore they use less materials per unit of GDP or even in absolute terms. Moreover, Ecological Modernization Theory developed in northern Europe observed that some capitalist firms appeared to be incorporating environmental considerations into their decision-making. Both these trends led many observers to assert that economic growth was decoupling from resource consumption, indicating a sort of environmental victory. However, the Environmental Kuznets Curve hypothesis was not confirmed for the use of materials, as economic growth did not lead to less use of materials (in relative terms or even in absolute terms).

A related claim made by World Bank and World Trade Organization analysts states that exports from developing nations are being upgraded and are increasing poor nations' expectations for higher economic growth and development. These arguments however have recently been questioned by researchers constructing a literature on ecologically unequal exchange. Their empirical findings suggest that trade relations remain strongly unbalanced and unfair because many poorer nations (and regions) export large quantities of under-priced goods whose value does not take into account the environmental and social costs of extraction, processing, or shipping. Moreover, the metropolitan regions or countries require for their metabolism increasing amounts of energy and materials at cheap prices.

Ecologically unequal exchange thus refers to the act of exporting goods from poor countries at prices which do not take into account local externalities or depletion of natural resources generated by these exports, in exchange for the purchase of expensive goods and services from richer regions. It focuses on poverty and the lack of political power of the exporting region to stress the lack of alternative options. This exchange of exports from poor to rich nations against goods or services from rich to poor countries tends to be organized by multinational corporations or partnerships between elites in poor nations and import firms in rich nations. This process is facilitated by the International Monetary Fund and World Bank through their structural adjustment loans which require poor countries to stimulate exports of natural resources by devaluing currency and providing various regulatory concessions (such as environmental law waivers) and financial incentives (tax holidays) to foreign investors in return for their money.

Causes and effects

Alf Hornborg explained the structural roots of ecologically unequal exchange in 1998. The rich metropolitan regions of the world require a net inflow of energy and materials at low prices for their social metabolism. Therefore, exporting regions have trade deficits in physical terms, exporting more tons than they import, and selling their exports at a lower price than they pay for their imports. This is a structural condition of the world system. Large amounts of oil, coal and gas flow from relatively poor regions to rich regions. Moreover, during long periods of time there is a constant decrease prices of exports from poor nations (largely natural resources) relative to the prices of exports from wealthy nations (largely manufactured goods or services). As a consequence of this deterioration in terms of trade, more and more natural resource (e.g., forestry) or other primary product (e.g., agriculture and mining) exports are required to purchase imports from rich nations. This often entails extensive degradation in poor nations (e.g., forest loss, water pollution, and air pollution) as increased export production is required to maintain levels of imports. The obligation to pay external financial debts is another factor forcing exports of raw materials.

For example, the export oriented cattle industry in some regions of Latin America is a main contributor to domestic forest degradation. Local elites and transnational firms

own and operate most of the high density livestock operations, and meatpacking plants prepare meat for export to the US and to other growing markets in developed countries. Another example is the case of logging corporations degrading the forest in many countries. European-based firms exploited the proximity of West African forests to the coast for export to European markets. These firms even gained access to forested areas in Ghana, Cameroon (see the CEECEC case study on Foresty in Cameroon), and the Ivory Coast, with the majority of wood exported to high-consuming European countries.

Beyond a clear contribution to various forms of environmental degradation, ecologically unequal exchange leads to other problems in poor nations as well, especially poverty and inequality. It also seems to play a role in the particularly important area of global climate change. Indeed, statistical research suggests that participation in international trade increases CO_2 emissions in poorer countries while lowering them in wealthier countries. Therefore, while national CO_2 emissions data may suggest a shift towards relatively low-carbon lifestyles and economies in the north, such countries are not necessarily emitting less, but may simply be displacing their emissions (like "outsourcing" the production of their energy-intensive goods to developing countries). These findings have led to the proposition that the richer nations owe some sort of remuneration (an ecological debt) to poorer nations for the environmental damage embodied in their energy (and material) intensive goods. It is said that wealthy nations have been accumulating a huge debt over centuries by exploiting the raw materials and ecosystems of poor countries.

Analysis

The empirical analysis of ecologically unequal exchange theory has become quite popular among ecological economists who analyze material flows. They have developed detailed accounting frameworks aimed at measuring flows of minerals, fossil fuels and biomass. However, this approach tends to focus on single nations. In order to apply the approach cross-nationally, Jorgenson (2006) developed a more comprehensive measure of "weighted export flows," which enables researchers to test insights of ecologically unequal exchange using data for a large sample of nations. Jorgenson's weighted export flow measure quantifies the extent to which the exports of a given nation are sent to wealthier nations. A higher value on this measure means that a nation sends a higher percentage of its total exports to richer nations.

References

A. Hornborg, Toward an ecological theory of unequal exchange, Ecological Economics 25 (1) (1998), 127–136

A.K. Jorgenson (2006), Unequal ecological exchange and environmental degradation: A theoretical proposition and cross-national study of deforestation, 1999-2000, *Rural Sociology*, *71*, 685-712

R. Muradian, M. O'Connor and J. Martinez-Alier, (2002), Embodied pollution in trade: Estimating the "environmental load displacement" of industrialized countries, *Ecological Economics*, 41: 51-67

J. Rice (2007a.), Ecologically unequal exchange: Consumption, equity, unsustainable structural relationships within the global economy, *International Journal of Comparative Sociology*, *48*, 43-72

29. Economic Valuation

Theoretical framework

Economists value the environment placing a monetary value on 'goods' and 'bads' arising from changes in environmental quality or resource availability. The rationale for the economic valuation of natural resources is that they somehow impact on the utility (or well-being) of individuals, and that these individuals can identify a satisfactory trade-off between quantities of money and the environmental "goods" and "bads" they want. The objective is to find ways to measure the wide range of effects of environmental change on a single monetary scale. Money is used as the measuring stick to evaluate, although imperfectly, the extent to which individual utility is affected. This approach necessitates applyiing a monetary value to goods that do not have a market value, in an attempt to extend the utilitarian principle of the free market into environmental decision-making.

The economic valuation approach makes several important assumptions (see, for example, Edwards-Jones et al, 2000), including commensurability of values, and assumes a compensatory approach in the evaluation of environmental changes, corresponding to a weak sustainability approach. The total economic value (TEV) of a resource indicates the total value of the resource in so far as it affects human welfare and integrates two broad categories of values: use values, associated with the direct contact with the natural resource in some way, and non-use values, corresponding to the value derived from a resource, either directly or indirectly, but that does not depend on the use of that resource. A full taxonomy of such economic values can be found in any economic valuation handbook (e.g. Dixon et al, 1998), including values categories such as option value, bequest value and existence value.

29.1 Contingent Valuation

Introduction and definition

The contingent valuation method (CVM) is a widely used method for estimating economic values for all kinds of ecosystem services and environmental goods which

are not traded in the market and hence have no market price. CVM is typically used to estimate the benefits (or costs) of a change in the level of provision (or in the level of quality) of a public good. This information can then be used in a cost benefit analysis which assesses the impacts of government project or policy. For instance, imagine an increase in public investment out of current taxes for improving the quality of the water in a river by treatment of the sewerage. It is easy to count the costs: the amount of money spent. But what are the benefits? We could try to count them one by one in their respective units, for instance better public health, less bad smells, availability of non-contaminated fish... Or we could ask a representative sample of the concerned local population how much they would have been willing to pay (in the forms of taxes for instance) in order to improve the quality of the water. Adding these results over the whole population, we would have a monetary representation of the benefits obtained.

Use and Non Use Values

CVM can be used to estimate both use and non-use values and it is the most widely used method for estimating non-use values. Use values are those values which are derived from actual use of a good or service, such as visiting a national park or using a beach for recreation. The non-use values do not involve direct use of a resource or ecosystem service. They include everything from the basic life support functions associated with ecosystem, health or biodiversity, to the enjoyment of a scenic vista, having an option to fish or watch birds in the future, or to bequest those options to grandchildren. It also includes the value people place on simply knowing that giant pandas, whales, a certain protected area or a beach exist, even though they will never see or visit them.

Willingness to Pay and Willingness to Accept

The method is applied through conducting a survey in which people are directly asked how much they would be willing to pay (WTP) for a (change in) specific environmental service. It is also possible to ask people what the amount of compensation is that they would be willing to accept (WTA) to give up an environmental service. The first approach is more recommendable. It is called “contingent” valuation because people are asked to state their willingness to pay, contingent on a particular scenario and the environmental service described to the respondent.

The first step is to define a (change in) a good or service being valued (e.g. improving a lake water quality that would lead to a 20% increase in fish stock). Then decisions about the survey itself are made, such as whether it will be conducted by mail, phone or in person, how large the sample size will be and who will be surveyed (e.g. only visitors or both visitors and non-visitors; individuals at the local, national or international scale). Answers to questions regarding survey method and sample size depend mainly on the size of the research budget, while the choice of subjects will depend on the 1) whether one decides to estimate only use or both use and non-use

values, and 2) on the uniqueness of goods or services being valued (resources with unique characteristics are likely to have higher non-use value and thus the geographical scope of the survey should be larger). In-person interviews are generally the most effective for complex questions, because it is often easier to explain the information to respondents in person. Also, people are more likely to complete a long survey when they are interviewed in person. However, these are also the most expensive type of surveys. The survey sample should be a randomly selected sample of the relevant population (e.g. every 10th visitor of a national park).

Survey Design

A contingent valuation survey should include (1) a detailed description of a good or service being valued and the hypothetical change regarding the good or service, (2) questions about willingness to pay for a good or service being valued, and (3) questions about respondents' characteristics (age, income, education) and preferably also their *preferences* regarding the good or service. The willingness to pay question should also define a way in which payment would be made (a general tax, a voluntary donation or an entrance fee). For example, a question can be formulated in the following way: "Are you willing to pay __€ for the previously described improvement of the river water quality *in the form of a voluntary donation* per year?". The valuation question is usually followed by a question which identifies the motivation of those respondents who state that they are not willing to pay anything. This enables distinguishing between the so-called protest votes (respondents who are not willing to pay anything because they protest against a scenario presented or a payment method, not because their real value for the good is zero) and the people for whom the good indeed has no value. Protest votes are in most cases excluded from the statistical analysis as they do not reveal people's real value for the good.

Some authors (like Sagoff, in *The Economy of the Earth*) interpret protest answers as refusals to act as consumers when deciding public policies. He believes that the economic approach, which treats individuals as consumers with certain p*references* is limited and that policy issues should be decided by rational legislative deliberation. Thus, he argues that people refuse to give a price because they want to act as "citizens" (deciding upon policy matters by voting, demonstrating, debating) and not as "consumers" in a fictitious market.

The next step is to conduct the survey, which is followed by statistical analysis and reporting of the results. The main result derived from the CVM is the average willingness to pay per person. This figure is then multiplied by the relevant population (all visitors of a beach or all residents of a country, for instance) in order to derive total economic value of a good or service. For example, if the average willingness to pay of surveyed people for establishing a protected marine area is 20€ per person per year, and the relevant population amounts to 200.000 (e.g. annual visitors of the site), then the total benefits of such a project would be €4 million.

Limitations

Although CVM has been widely used in cost benefit analysis and environmental impact assessment for several decades, it has been subject to many critiques. The main concern relates to the reliability and validity of its results due to a number of errors or biases that can occur when applying CVM. The most important biases are:

-when respondents are asked about their willingness to pay hypothetically they tend to give higher values than what they would actually pay in a real situation

-rather than expressing value for the good or service, the respondents might sometimes actually be expressing their feelings about the scenario or the valuation exercise itself (they do not believe that a described change is feasible or that it will really take place)

-respondents may give different willingness to pay amounts, depending on the specific form of payment chosen (e.g. if the form of payment is voluntary donation respondents may give higher values than if asked to pay through higher taxes)

-starting value in the willingness to pay question tends to imply a value for the good (e.g. "Are you willing to pay €5 for…?"), so that a starting value well above the respondent's true willingness to pay amount will increase the stated willingness to pay amount, while starting value well below it will tend to decrease it

-strategic bias arises when the respondent does not provide a true answer in order to influence a particular outcome, i.e. provision of a good

-non-response bias is a concern because individuals who do not participate in the survey are likely to have different values than individuals who do take part in it

References

For a short description of CVM as well as several examples of its application:
www.ecosystemvaluation.org/contingent_valuation.htm

29.2 Cost benefit analysis

Cost-benefit analysis (CBA) is the primary tool / analytical method for economic valuation in public decision-making processes. It is based on a utilitarian ethic, in which changes in utility arise from changes to marketed and non-marketed commodities. The theoretical origins of CBA date back to infrastructure appraisal efforts of France in the 19th century but it was popularized by the World Bank after 1945 especially for the building of dams.

CBA involves valuing, adding up, and comparing in monetary terms the positive (benefits) and negative (costs) effects associated with a particular action/decision. The values of economically relevant costs and benefits over the lifespan of an action are expressed using indicators such as net present value (NPV). For economists, the objective of CBA is to select the most efficient action(s) in terms of resource use.

According to CBA criterion, a policy/program/project is justifiable in terms of the public interest and contributes to social welfare if the benefits, to whomever they accrue, outweigh the estimated costs (i.e., NPV is greater than zero).

This approach is in line with the Kaldor-Hicks potential compensation principle, which is a very widely accepted variation on the Pareto criterion. Pareto efficiency is achieved when it is not possible to make some (or all) people better off without making others worse off. The Kaldor-Hicks principle only requires that the *net gains* from an action are positive. If society as a whole gains with the action, and if it is, at least in theory, possible to transfer some of the winners´ gains to the losers, then the project is in the public interest. CBA is intended to help decision-makers to identify projects/programs with potential net gains by evaluating all relevant costs and benefits.

CBA methods

There are several important steps in a CBA:

- Perspective: decide on the perspective from which the study is to be done (Eg: societal, governmental, provider, payer...);

- Project definition: develop a complete specification of the main elements of the project or program and implications in terms of resource allocation (e.g location, timing, groups involved, population of affected people, connections with other projects/programs);

- Classification of impacts: determine the full range of consequences of the project/program, including a physical and quantitative description of the inputs and outputs (e.g. consumption of materials, emissions, effects on local employment levels, land occupation). This can be difficult for regulatory programs;

- Conversion into monetary terms: placing monetary values, estimating the social costs and benefits of these inputs and outputs (including adjustments for inflation and shadow prices);

- Compare the benefits and costs: the various costs and benefits over time are made commensurate through a process known as "discounting", which converts them into what they would be worth today. The fundamental assumption is that future costs and benefits count for less than present ones. To calculate the present values of costs and benefits it is important to select the appropriate discount rate, which is a difficult and sometimes controversial task (see, for example, Field and Field, 2009);

- Project assessment: several indicators can be adopted to make judgements about the overall value of the action under study (e.g. net present value, benefit/cost ratio, distribution of costs and benefits). The relation between total benefits and total costs is a question of economic efficiency. But the distributional issues are also very relevant. Distribution is a matter of who gets the benefits and who bears the costs;

- Sensitivity analysis: since several types of uncertainty are present in a CBA exercise, it is important to test the influence upon decision indicators of changes in the most important variables.

A wide range of techniques have been developed for performing economic environmental valuation, namely for valuing goods and services that do not have a market value. These techniques have been classified in many different ways. For example, Munasinghe (1993) considers three broad groups of economic techniques: a) conventional market approaches – establishing a link between an environmental impact and some other good with a market value (e.g. defensive or preventive expenditures; replacement or restoration costs); b) implicit market approaches – assuming that the behaviour of individuals reveals implicit valuations of features of the environment (e.g. hedonic pricing methods; travel cost method); c) constructed market approaches – simulating a hypothetical market of a particular good or service (e.g. contingent valuation).

Applications

CBA has been widely applied and endorsed in both public and private decision-making processes. Applications in the environmental area can include the assessment of investment and development projects (e.g. public waste treatment plants; beach restoration projects; habitat improvement projects) or policies (e.g. pollution-control standards, restrictions on land development). In the United States, CBA was first used in conjunction with the United States Flood Control Act of 1936. The "Regulatory Right to Know Act", from 2000, required that agencies conduct a CBA of their programs and regulations (USEPA. 2005).

Objections and Criticisms

The status and potential role of CBA in ecological economics is controversial. Several objections and criticisms are described in the literature and/or are part of the scientific debate (e.g. Baer and Spash, 2008; Spash, 2007; Vatn, 2000; Edward-Jones et al, 2000; Hanley and Spash, 1993; Martinez-Alier et al, 1998). Historically, CBA was developed to evaluate well defined small-scale projects, but even at project level there is often skepticism relating to the necessary simplifications and assumptions. Skepticism increases when CBA is used for global-scale problems, where uncertainties surrounding the relationship between causes of environmental problems, their potential impact and valuation raise additional challenges (e.g. Baer and Spash, 2008).

Critiques and objections to CBA are mainly related to the controversial ethical choices and practical application involved, and include aspects such as its: a) incapacity to acknowledge incommensurability and to capture non-economic values; b) incapacity to distinguish distributional aspects (e.g. CBA treats gains and losses equally and is unconcerned with who gains and who loses) assuming the possibility of appropriate compensation, which has implications for equity; c) problems with discounting and its approach to accounting for future generations and non-human species; d) approach to dealing with risk, uncertainty, ignorance and ecosystem

complexity, including non-linear and stochastic (random) relations; e) accuracy and acceptability of monetary valuations; f) treatment of irreversibility; g) potential for manipulation and institutional capture; h) lack of a strong sustainability criterion; i) reliance on consumer values which are a limited subset of all values in society (citizen values). In the CBA of dams, Krutilla introduced an interesting discussion in 1967 using different discount rates for benefits and for costs.

Despite the considerable range and number of serious critiques however, the CBA approach remains influential and continues to be applied to valuation of the environment, as it can provide relevant information concerning economic aspects of multicriteria assessment processes.

References

Baer, P., Spash, C. 2008. Cost-Benefit Analysis of Climate Change: Stern revisited**.** Socio-Economics and the Environment Discussion CSIRO Working Paper Series 2008-07. May 2008. ISSN: 1834-5638, CSIRO, Australia.

Common, M., Stagl, S., 2005, Ecological Economics – an introduction, Cambridge University Press, Cambridge.

Dixon, J.A., Scura, L.F., Carpenter, R.A., Sherman, P.B. 1998. Economic Analysis of Environmental Impacts. Earthscan Publications Ltd, London.

Field, B., Field, M., 2009, Environmental Economics: an introduction, 5th edition, McGraw-Hill, New York.

Hanley, N., Spash, C. 1993. Cost-Benefit Analysis. Edward Elgar Publishers, Aldershot.

Martinez-Alier, J., Munda, G., O'Neill, J. 1998. Weak comparability of values as a foundation for ecological economics. Ecological Economics, 26, 277–286.

Munasinghe; M.C., 1993. Environmental Economics and Sustainable Development. World Bank Environment Paper No.3. The World Bank, Washington DC.

Spash, C. 2007. The Economics of Climate Change: The Stern Review. *Environmental Values* **16**(4): 532-535.

Tietenberg, T., Lewis, L., 2009. Environmental and Natural Resource Economics, 8th edition, Pearson International Edition, Addison Wesley, Boston.

USEPA. 2005. Benefits Transfer and Valuation Databases: Are We Heading in the Right Direction?, Proceedings of an International Workshop Sponsored by the U.S. Environmental Protection Agency's National Center for Environmental Economics and Environment Canada, March 21-22, 2005 Ronald Reagan Building Washington, D.C.

Vatn, A. 2000. The environment as commodity. *Environmental Values* 9(4): 493-509.

Websites

http://www.costbenefitanalysis.org

http://buvd.ucdavis.edu/

http://www.evri.ca

29.3 Discount Rate

Basic definition

For the purposes of investors, interest rates, impatience and risk necessitate that future costs and benefits are converted into present value in order to make them comparable with each other. The discount rate is a rate used to convert future value into current or present value. This is realized through the mechanism known as discounting. For instance, if somebody offers to pay to you 105 € one year from now, the present value is 100 € at a discount rate of 5%. This is because you would earn interest of 5 € on a deposit of 100 €. (See "Net Present Value" for more numerical examples).

Justification for discounting

There are two main reasons for discounting. The first, called "pure time preference", refers to the inclination of individuals to prefer 100 units of purchasing power today to 101, or 105, or even 110 next year, not because of price inflation (which is excluded from the reasoning) but because of the risk of becoming ill or dying and not being able to enjoy next year's income. The most famous critique of "pure time preference" came from the Cambridge economist Frank Ramsey in 1928, which observed that discounting later enjoyments in comparison with earlier ones is "a practice which is ethically indefensible and arises merely from the weakness of the imagination". But economists continue to discount the future, as Ramsey himself did, because of the second, and more contemporarily relevant reason: economists assume that today's investments and technical change will produce economic growth. Our descendants will be richer than we are. They will have three, four or even more cars per family.

Therefore, the marginal utility, or incremental satisfaction they will get from the third, fourth or fifth car, will be lower and lower. Discounting is justified by the expectation of economic growth. But Ramsey did not take environmental considerations into account.

Methodology

We generally discount future amounts of money using constant discount rates, that is, discount factors of the form $1/(1+r)^t$. This is usually called "exponential discounting", and it implies that values in the distant future tend to have present values close to nothing. Thus, discounting reflects the balance between present and future well being. Low discount rates imply important sacrifices for present generations while high discount rates imply giving low values to future damages, and thus, betting against the environment and future generations.

A distinction can also be made between **public or social** discount rates and **private** discount rates. Both sectors use a positive discount rate (that is $r > 0$) but there is a difference in the fact that the social discount rate is generally lower than the private discount rate. This is for two reasons:

1. Individuals (private sector) are mostly concerned with their own welfare in the very short term, discounting future benefits heavily. On the other hand, the public sector (society as a whole) tends to have a longer-term perspective, entailing lower discount rates.
2. Individuals are more risk-averse, more uncertain about the future than the rest of society, or this is at least what is argued. The discount rate is thus adjusted upward to reflect the greater risk associated with private projects.

Discount rates and sustainability

Whatever the reason for attitudes in favour of discounting, its application to nations or societies with time horizons in the thousands of years is highly questionable, one of the most heavily debated issues in ecological economics. The relationship between future generations and discounting is a crucial issue in discussions of intergenerational equity. High or positive discount rates shift the costs of environmental degradation to later generations, and reduce incentives for long-term environmentally favourable projects. But high discount rates (i.e. high rates of interest) also reduce levels of investment because borrowing money become more expensive and this in turn decrease the use of natural resources. In this case, intergenerational equity and environmental objectives are incompatible to an extent.

From the environmental point of view, instead of exponential discounting when assessing future costs and benefits, a slowly declining rate of discount could be used to give more value to the future. What is really needed however are very low discount rates, with investment (which will increase because of low interest rates) subject to a second filter to ensure their environmental sustainability.

Concerns

Projects dealing with preservation of environmental assets, such as coastal wetlands, wilderness, national parks or estuaries are highly sensitive to discounting, and usually evaluated on the basis of preferences of the current generation. However, environmental costs and benefits often accrue to future generations. In these situations, it is questionable whether the use of a positive discount rate is ethical. For many economists, the use of a positive discount rate reflects people's preference for present consumption, and is considered the appropriate method. For projects addressing environmental issues however, a very low or even a zero social discount rate in the interests of distributional fairness among generations would seem more appropriate. Even minor discounting implies unequal weighting of costs and benefits over time, it is doubtful whether a positive discount rate *can* bring distributional equity. In response to this dilemma, economists have put forth three responses: (1) generational overlap means that current generations take the interests of future ones into account; (2) a zero social discount rate could impoverish the current generation; and (3) historically, the income of current generations has always been higher than of earlier ones, and we can continue to expect future economic growth.

When the conservation of amenities of the natural environment is at stake, some economists (as Krutilla, 1967) argue for very low or zero discount rates. The reason is that for projects with long time horizons, any discounting reduces future costs and benefits almost to zero after a finite number of years. This implies a bias for projects with either short-term benefits (such as development projects rather than projects designed to preserve environmental amenities) or long-term costs (such as the creation of a nuclear plant). In both cases, the well-being of future generations is in danger. Given this, some economists argue that intergenerational equity justifies no discounting at all. Others have even gone further and argued for negative discounting to reflect a need for greater protection of the interests of future generations in natural resource management decisions, as for example in the case of irreversible outcomes such as global warming.

The optimist's paradox

Economic growth might produce virtual Jurassic Theme Parks for children and adults, but it will never resurrect the tiger if and when it becomes extinct. Economic growth theory does not include it in its accounting the costs of the loss of nature, or those of defensive expenditures by which we try to compensate for nature's loss (building dykes against sea-level rise induced by climate change, or selling bottled water in polluted areas). If one tried to add up the genuine growth of the economy resulting from positive technical changes and investments (which nobody would deny), and the loss of environmental services caused by economic growth, the balance would be doubtful. Furthermore, it would involve accounting with complete disregard for incommensurability of values.

Discounting thus gives rise to an “optimist’s paradox”. Modern economists favour discounting not because of “pure time preference” but (as Ramsey wrote in 1928) because of the decreasing marginal utility (or incremental satisfaction) of consumption as growth takes place. The assumption of growth (measured by GDP) justifies our using more resources and polluting more now than we would otherwise do. Therefore our descendants, who by assumption we anticipate will be better off than ourselves, might paradoxically be worse off from the environmental point of view than we are. Intergenerational equity then requires the incorporation of the widest possible range of economic, ecological, moral, and ethical concerns.

References

E. Padilla, 2002. Intergenerational equity and sustainability, *Ecological Economics*, 41(1), 69-83

C. Gollier, 2002, “Time Horizon and the Discount Rate”, *Journal of Economic Theory*, 107(2), 463-73.

C. Philibert, 2003, “Discounting the future”, *International Society for Ecological Economics*, *Encyclopaedia*

(available at http://www.ecoeco.org/education_encyclopedia.php)

29.4 Net Present Value

Basic definition

The idea behind the net present value (NPV) is that one Euro today is worth more than one Euro in the future because money available today can be invested and grow. In this regard, it is essential for decision makers to be able to compare the value of money today with the value of the money in the future, in order to determine whether or not to invest in a project.

NPV is a calculation technique used to estimate the value or net benefit over the lifetime of a particular project, often for long-term investments, such as installing energy efficient machines. It allows the decision-maker to compare different alternatives on a similar time scale by converting all options to current monetary figures. A project is considered acceptable (or unacceptable) if the NPV is positive (or negative) over the expected lifetime of the project.

The formula for NPV requires anticipating the time period for which (expressed as t, usually in years) money will be invested in the project, the total length of time of the project (expressed as N, the same unit as t), the interest rate (i) and the cash flow at that specific point of time (C, cash inflow or outflow). With these elements, NPV can be calculated as follows:

$$NPV = \sum_{t=0}^{n} \frac{C_t}{(1+i)^t}$$

An illustration

An illustration can be made by way of a business that is considering changing its lighting by switching from incandescent to fluorescent bulbs. The initial investment to change the lights themselves amounts to €40,000. After the initial investment, this project expects to spend €2,000 to operate the lighting system but, on the other hand, it will also yield €15,000 in savings each year. Therefore, there is an annual flow of €13,000 following the initial investment. If the discount rate is assumed to be 10% and the lighting system is utilized over a 5 year period, the project would have the following NPV calculation:

$$t = 0,\ NPV = \frac{-40{,}000}{(1+0.10)^0} = -40{,}000.00$$

$$t = 1,\ NPV = \frac{13{,}000}{(1+0.10)^1} = 11{,}818.18$$

$$t = 2,\ NPV = \frac{13{,}000}{(1+0.10)^2} = 10{,}743.80$$

$$t = 3,\ NPV = \frac{13{,}000}{(1+0.10)^3} = 9{,}767.09$$

$$t = 4,\ NPV = \frac{13{,}000}{(1+0.10)^4} = 8{,}879.17$$

$$t = 5,\ NPV = \frac{13{,}000}{(1+0.10)^5} = 8{,}071.98$$

The information above allows us to calculate the NPV over the lifetime of the project, that is the sum of the 6 rows (from $t = 0$ till $t = 5$) equals €9,280.22. Notice how much the calculation depends on the interest rate or discount rate. A lower rate will favour the change in lights. The question arises, why is the discount or interest rate 10%, or 5% or 2%? Does money “reproduce” itself at 10% per year? Which are the investments that will sustainably yield such a rate of return, once we take out the value of resource depletion and environmental pollution?

Alternative choices and depreciation

Once the NPV is calculated, various alternatives can be compared and choices can be made. Any project with a negative NPV should be dismissed because it implies that this project will probably lose money or at least not create enough benefits. On the contrary, every proposal with a positive NPV should be chosen or, in case of several projects with positive NPVs, the choice would be the alternative with the

higher NPV. In most societal choices, the opportunity costs are also considered when making decisions. NPV provides the possibility to minimize foregone opportunity and identify the best possible options. NPV calculations can also be used to account for depreciation. Most assets depreciate over time or, in other words, they lose value. Decision makers should be able to compute a rate that includes depreciation for account balancing and tax purposes, as well as to predict replacement times for the asset in question. NPV and depreciation calculations are strongly valuable in the world of economics since they tell us what projects are better investments and what outcome we may expect in the future.

However, estimations of depreciation rates for natural resources and other environmental issues are rather uncertain. Indeed, natural resources don't always lose value over time. Therefore, in most cases natural resources should not be depreciated when calculating resource NPVs. Also, since there is uncertainty about the future and external effects exist, it is much easier to predict what a company can do and what the reaction will be in the structured world of business than to accurately assess for example the value of a forest to a local economy in future years.

Criticism

There are several disadvantages to using NPV as an investment criterion. The biggest disadvantage is its sensitivity to the discount rate, which is critical in determining the NPV. A small increase or decrease in the discount rate will have a considerable effect on the final output. In our example, if we set the discount rate at 15%, the NPV equals €3,578.02. A discount rate of 20% entails a NPV of €-1,122.04. We thus come from a project that creates €9,280.22 of value to one that destroys €1,122.04 instead. The main difficulty then in computing the NPV of a project is determining which discount rate should be used, and how to project future changes in the discount rate. This is an issue that there is simply no getting around. The use of NPV will also continue to be controversial because of the practice of applying discounting to natural resources/ecosystems in light of their tendency to increase in economic value with the passage of time. Ecosystem valuation is clearly a complex process that does not always result in the assignment of accurate values to natural resources.

References

Baker S.L., 2000, "Perils of the Internal Rate of Return" available at http://hspm.sph.sc.edu/COURSES/ECON/Invest/invest.html

29.5 Travel Cost Method

Introduction and definition

The travel cost method (TCM) is used for calculating economic values of environmental goods. Unlike the contingent valuation method, TCM can only estimate use value of an environmental good or service. It is mainly applied for determining economic values of sites that are used for recreation, such as national parks. For example, TCM can estimate part of economic benefits of coral reefs, beaches or wetlands stemming from their use for recreational activities (diving and snorkeling/swimming and sunbathing/bird watching). However, it cannot estimate benefits of providing habitat for endemic species or offering scenic beauty. It can also serve for evaluating how an increased entrance fee to the Lastovo Islands Nature Park would affect the number of visitors and total park revenues from the fee.

TCM is based on the assumption that travel costs represent the price of access to a recreational site. Peoples' willingness to pay for visiting a site is thus estimated based on the number of trips that they make at different travel costs. It is also called a revealed preference technique because it "reveals" willingness to pay based on consumption behavior of visitors.

Application

The information is collected by conducting a survey among the visitors of a site being valued. The survey should include questions on the number of visits made to the site over some period of time (usually during the last 12 months), distance travelled from visitor's home to the site, mode of travel (car, plane, bus, train, etc.), time spent travelling to the site, respondents' income and other socioeconomic characteristics (gender, age, degree of education). The information on distance and mode of travel serve for calculating travel costs, which is usually done by a researcher. Alternatively, visitors can be asked directly in a survey to state their travel costs, although this information tends to be somewhat less reliable. Time spent travelling is considered as part of the travel costs because this time could have been used for doing other activities (e.g. working, spending time with friends or enjoying a hobby). The value of time is determined based on the income of each respondent. Time spent at the site is for the same reason sometimes also considered as part of travel costs. It is also recommendable to gather information about other sites that respondents visit on the same trip and time they spend at each site. This enables allocating proportional part of total travel costs for each site. For example, if respondents visit three different sites in 10 days and spend only one day at the site being valued then only fraction of their travel costs should be assigned to this site (e.g. 1/10).

Two approaches of TCM are distinguished – individual and zonal. Individual TCM calculates travel costs separately for each individual and requires a more detailed survey of visitors. In zonal TCM the area surrounding the site is divided into zones, which can be either concentric circles or administrative districts. In this case, the

number of visits from each zone is counted. This information is sometimes available (from the site management for example), which makes data collection from the visitors simpler and less expensive.

The relationship between travel costs and number of trips (the higher the travel costs, the fewer trips visitors will take) shows us the demand function for the average visitor to the site, from which one can derive the average visitor's willingness to pay. This average value is then multiplied by the total relevant population in order to estimate the total economic value of a recreational resource.

Limitations

TCM is based on the behavior of people who actually use an environmental good and therefore cannot measure non-use values. This method is thus inappropriate for sites with unique characteristics (e.g. Grand Canyon), which have a large non-use value component (because many people would be willing to pay for its preservation just to know that it exists, although they do not plan to visit the site in the future).

Furthermore, there are several methodological issues which remain unsolved. For example, in cases where respondents visit several destinations on the same trip, which part of the travel cost should be allocated to the site being valued? There are several options, such as allocating the costs in proportion to the time spent on each site, according to the importance of a visit to each site for the respondent, or excluding such respondents from the analysis. Obviously, each approach generates different benefit estimates. Moreover, the method assumes that all trips are of the same length (this usually implies that all visits are one-day trips), which is often not the case in practice. It has been suggested that when the length of trips varies, either daily travel costs should be considered or all trips of the same length should be grouped and then each group analyzed separately. Alternatively, multiple-day trips can be excluded from the analysis. However, estimates will differ depending on the approach selected. Another very important issue in TCM is the value of time spent travelling. Since time could be used in other ways (to work and earn extra money, for instance), it is considered as part of the travel costs. But how should the cost of time be measured? Usually either full or a fraction (e.g. one-third) of individual's wage rate is applied. However, depending on the fraction used, the final benefit estimates can differ considerably.

References

Ward, F.A., Beal, D., 2000. *Valuing nature with travel cost models. A manual*. Edward Elgar, Cheltenham.

Websites:

www.ecosystemvaluation.org/travel_costs.htm

30. Ecosystem Services

Ecosystem goods and services

Humans have always depended on nature for environmental assets like clean water, nutrient cycling and soil formation. These have been called by different names through human history, but are presently gaining global attention as 'ecosystem services'. Gretchen Daily has defined ecosystem services as '*the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfil human life*' (Daily, 1997). They maintain biodiversity and the production of ecosystem goods, such as seafood, forage, timber, biomass fuels, natural fibre, and many pharmaceuticals, industrial products and their precursors. The harvest and trade of these goods represents an important and familiar part of the human economy. In addition to the production of goods, ecosystem services include life-support functions, such as cleansing, recycling and renewal, and they confer many intangible aesthetic and cultural benefits as well (Daily, 1997).

Ecosystem services transform natural assets (soil, plants and animals, air and water) into things that we value. For example, when fungi, worms and bacteria transform the raw "ingredients" of sunlight, carbon and nitrogen into fertile soil, this provides an ecosystem service. Some authors distinguish ecosystem *functions* from services. Ecosystem functions can be defined as 'the capacity of natural processes and components to provide goods and services that satisfy human needs, directly or indirectly' (de Groot, 1994; de Groot et al., 2002). Four different categories of ecosystem functions can be distinguished:

- **Regulation functions**: that relate to the capacity of natural and semi-natural ecosystems to regulate essential ecological processes and life support systems through bio-geochemical cycles and other biospheric processes. In addition to maintaining ecosystem (and biosphere) health, these regulation functions provide many services that have direct and indirect benefits to humans (such as clean air, water and soil, and biological control services).

- **Habitat functions**: natural ecosystems provide refuge and reproduction habitats to wild plants and animals and thereby contribute to the conservation of biological and genetic diversity and evolutionary processes.

- **Production functions**: photosynthesis and nutrient uptake by autotrophs (organisms such as plants or algae that produce their own food, such as carbohydrates , fats or proteins, using photosynthesis or inorganic chemical reactions) converts energy, carbon dioxide, water and nutrients into a wide variety of carbohydrate structures, which are then used by secondary producers to create an even larger variety of living biomass. This broad diversity in carbohydrate structures provides many ecosystem goods for human consumption, ranging from food and raw materials to energy resources and genetic material.

- **Information functions**: because most of human evolution has taken place

within the context of undomesticated habitat, natural ecosystems provide an essential 'reference function' and contribute to the maintenance of human health by providing opportunities for reflection, spiritual enrichment, cognitive development, recreation and aesthetic experience.

Evolution and policy uptake of the concept

The concept of ecosystem services was introduced in the late 1970s and 80s by authors such as Westman (1977) and Erlich and Erlich (1981), building on earlier literature highlighting the societal value of nature's functions. Mooney and Ehrlich (1997) coined the the term 'environmental services' in the report *The Study of Critical Environmental Problems* (SCEP, 1970) identifying services such as pest control, insect pollination, fisheries, climate regulation, soil retention and flood control. The initial rationale behind the use of the ecosystem service concept was mainly pedagogic, and it was used mostly by natural scientists to demonstrate how biodiversity loss directly affected ecosystem functions underpinning critical services for human well-being, thus aiming at triggering action for nature conservation (Gómez-Baggethun et al., 2009).

The paper by Costanza et al. (1997) on the value of the global natural capital and ecosystem services was a milestone in the mainstreaming of ecosystem services. The monetary figures presented resulted in a high impact in both science and policy making, manifested both in terms of criticisms and in increasing the development and use of monetary valuation studies (Gómez-Bagethun et al., 2009). The term 'ecosystem services' gained even more popularity and policy relevance, with the publication of the Millenium Ecosystem Assessment (MA) (www.millenniumassessment.org), a four-year study involving more that 1300 scientists worldwide. Sponsored by the United Nations, it adopted a conceptual framework clearly linking ecosystem services to human well-being (MA, 2003). The MA concluded that over half of the world's ecosystem services are being degraded or used unsustainably (MA, 2005). The publication of this assessment placed the concept of ecosystem services at the top of biodiversity policy agenda and has led to an exponential increase in the publication of ecosystem valuation studies. Currently, The Economics of Ecosystems and Biodiversity (TEEB) (http://www.teebweb.org/) is a major international initiative to evaluate the costs of biodiversity loss and the associated decline in ecosystem services worldwide, comparing them with the costs of effective conservation and sustainable use.

Concerns

Growing awareness of the value of ecosystem services, and of the costs associated with their loss, has led to the development of programs and policy initiatives based on the establishment of markets for ecosystem services and in the implementation of payment for ecosystem services (PES) schemes. In spite of the success of some policy initiatives and of the effectiveness of the use of the term 'ecosystem services' for communication purposes, some authors raise concerns regarding the perverse effects of this commodification of nature. For example, Peterson et al. (2010) point to

the risks of decoupling of ecosystem function from service, in that many people may be aware of the economic value of a given ecosystem service without recognizing human dependence on local and global ecosystems and on their functioning. The spread of the ecosystem service concept has in practice set the stage for the perception of ecosystem functions as exchange values that could be subject to monetization and sale, with profound ethical and practical implications (Gómez-Baggethun et al., 2009).

References

Costanza, R., R. d'Arge, R. de Groot, S. Farber, M. Grasso, B. Hannon, K. Limburg, S. Naeem, R. V. O'Neill, J. Paruelo, R. G. Raskin, P. Sutton, M. van den Belt, 1997. The value of the world's ecosystem services and natural capital, Nature, 387, 253-260.

Daily, G, 1997. Introduction: What Are Ecosystem Services? in Daily, G. (edt), Nature's Services. Societal Dependence on Natural Ecosystems, Island Press, Washington DC.

de Groot, R., 1994. Environmental functions and the economic value of natural ecosystems. In: A.M. Jansson, (Editor), Investing in Natural Capital: The Ecological Economics Approach to Sustainability, Island Press, pp. 151–168.

de Groot, R., M. Wilson, R. Boumans, 2002. A typology for the classification, description and valuation of ecosystem functions, goods and services, Ecological Economics, 41, 393-408.

Ehrlich, P.R., A. Ehrlich. 1981. Extinction: The Causes and Consequences of the Disappearance of Species. Random House, New York.

Gómez-Baggethun, E., R. de Groot, P. Lomas, C. Montes, 2009. The history of ecosystem services in economic theory and practice: From early notions to markets and payment schemes. Ecological Economics (in press), doi:10.1016/j.ecolecon.2009.11.007.

Millennium Ecosystem Assessment, 2003. Ecosystems and Human Well-being: A Framework for Assessment. Island Press, Washington, DC.

Millennium Ecosystem Assessment, 2005. Ecosystems and Human Well-being: Synthesis. Island Press, Washington, DC.

Mooney, H., P. Ehrlich, 1997. Ecosystem services: A fragmentary history. in Daily, G. (edt), Nature's Services. Societal Dependence on Natural Ecosystems, Island Press, Washington DC.

Peterson, M., D. Hall, A. Felspausch-Parker, T. R. Peterson, 2010. Obscuring ecosystem function with application of the ecosystem services concept, Conservation Biology, 24, 1, 113-119.

Study of the Critical Environmental Problems (SCEP), 1970. Man's impact on the global environment. MIT Press, Cambridge, MA.

Westman, W., 1977. How much are nature's services worth? Science, 197, 960-964.

Websites

http://www.millenniumassessment.org/en/index.aspx

http://www.teebweb.org/

31. Energy use

Distinction in energy use

Ecological economists distinguish (following A. Lotka's ideas of the 1910s) between "endosomatic" and "exosomatic" use of energy by humans. Inside the body, as food energy, adult humans spend per day between 1500 and 2500 kcal on average. A convenient number easy to remember is 2400 kcal, equivalent to 10 MJ (megajoules). Per year, the endosomatic energy use would then be 3.65 GJ (gigajoules, thousands of millions joules). If one person has five times the income of another person, he or she is not going to eat five times more in terms of kcal or joules.

Exosomatically, the use of energy varies according to income and style of living. All humans spend some energy for cooking food (typically more energy is spent in cooking than that in the food itself), and they use energy also for their houses and to produce clothes. In agricultural societies, much energy is used also for domestic animals. In industrial societies, the amount of energy for exosomatic use is drastically higher, whether it is for factories, for transport or for domestic use.

Patterns of energy use

A typology of societies (from hunter-gatherers to agriculturalists using animals to industrial society) reveals a pattern of exosomatic use of energy that increases from 20 GJ per person per year, to 60 GJ per person per year, to 200 or 300 GJ per person per year. The question arises whether the 6500 million people at present on earth, or the 8500 million at the estimated "peak population" towards 2050, will have enough available energy to supply the current level of 200 to 300 GJ per person per year in the rich societies. This is unlikely.

Biomass for food and for fuelwood continues to be an important source of energy for humans. There are programmes to produce “biofuels” for transport needs, but as an energy source biofuels show a low EROI, and moreover they increase the HANPP to the detriment of other species, and they require much “virtual” water in order to grow. The other main sources of energy at world level are oil (about 34%), coal (about 25%, increasing slowly), and gas (24%, increasing quickly). Oil extraction, at 85 million barrels per day in 2009, is reaching a maximum level (peak oil). Coal is plentiful but noxious locally, and also globally because of carbon dioxide emissions. About 7% of the energy supply comes from nuclear energy, 7% is hydroelectricy, and the rest comes from wind energy and solar energy (thermal or photovoltaic) which are increasing rapidly.

However, it will would be extremely difficult to completely substitute renewable energy for fossil fuels (coal, oil and gas) al the present level of energy use, let alone to increase energy use within a system based on renewable sources of energy.

References

M.Fischer-Kolwalski and H. Haberl, eds., *Socio-ecological transitions*, E. Elgar, Cheltenham, 2007.

32. Entropy

Basic definition

A simple way to grasp the fundamental meaning of entropy is to consider that all processes of change are irreversible. Examples include natural processes, such as the growing of a plant, as well as technical processes, such as the burning of fossil fuels in combustion engines. The entropy concept was coined in thermodynamics to capture this fact. Thermodynamics in the science of energy - the name comes from the study of how heat and movemeny convert into each other. Its origins are in the 19th century when scientists like Sadi Carnot, Rudolph Clausius and Lord Kelvin wanted to understand and increase the efficiency at which steam engines perform useful mechanical work. The original notion of entropy has been applied to different contexts outside thermodynamics.

Entropy can also refer to the amount of energy available to humans. As a piece of wood is burned, for example, its available energy – also called “exergy” – decreases as the wood is transformed into high entropy matter - carbon dioxide and other substances useless from an energy point of view, its original exergy dissipated as useless heat. Available energy corresponds to the useful part of energy, which can be transformed into work. The so-called Entropy Law (the “Second Law of Thermodynamics”) uses this definition of entropy to express the everyday experience that transformations of energy and matter are unidirectional. It states that the entropy of an isolated thermodynamic system never decreases, but strictly

increases in irreversible transformations and remains constant in reversible transformations. This places significant constraints on natural as well as technical processes. For example, the temperature of a cup of hot coffee left in a cold room will always decrease, never increase, to eventually reach equilibrium with room temperature. In this process, the entropy of the room has increased.

Energy from the sun (produced by atomic fusion) reaches the Earth in very large quantities. The Earth is not an isolated system. It is a system open to the entry of energy although closed to the entry of materials. The energy from the sun is the cause of photosynthesis and the source of the great wealth of life on the planet, i.e. the many forms of biodiversity. Therefore, one cannot jump from the existence of the Entropy Law to a pessimistic view regarding life and human life on Earth. However, in industrial economies we are using energy "stocks" of coal, oil, gas accumulated long ago. As they are used up, their heat content is dissipated. We cannot use these stocks again, or recycle such energy because of the Entropy Law.

Entropy and economics

In the analysis of economy-environment interactions, for example resource extraction, energy use, production, and generation of wastes, entropy is a useful concept. The Entropy Law states that with every energy-based transformation a system loses part of its ability to perform useful mechanical work. After a while, the system's potential for work becomes zero. In the 19th century, thinking that the universe as a whole could be described as an isolated system, it was said that its final state would be a state of maximum entropy and zero potential for work – a state described as "heat death". The evolution of an isolated system towards maximal entropy defines the so-called arrow of time as an expression of irreversibility in isolated systems. For the purposes of the analysis of the use of energy in the economy, we have no need to appeal to "heat death". In fact the economy is not an isolated system, it takes energy and materials from outside, and produces waste and dissipated heat.

Nicholas Georgescu-Roegen (1971), the founder of ecological economics, was the best known economist to realize that the Entropy Law imposes limits on the economic process when it is based on fossil fuels. He considered this "the most economic of all physical laws". His seminal work gave rise to a vast strand of fruitful research. The economy uses low entropy energy and matter from its surrounding natural environment (such as coal or oil), to produce consumption goods, and discards high entropy wastes and dissipated heat back into the environment (such as carbon dioxide).

Application

All taken together, the entropy concept is relevant for economics in various ways and on different levels of abstraction. First, as all processes of change are, at bottom, processes of energy and material transformation the entropy concept applies to all of them. It thus creates a unifying perspective on ecology, the physical environment,

and the economy. It allows us to ask questions that would not have been asked from the perspective of one scientific discipline alone. It points to irreversible processes of resource degradation.

Second, the concept allows us to incorporate physical driving forces and constraints in models of economy-environment interactions, both microeconomic and macroeconomic. It is essential for understanding to what extent resource and energy scarcity, nature's capacity to assimilate human wastes and pollutants, as well as the irreversibility of transformation processes, constrain economic action. The entropy concept thus allows economics to relate to its biophysical basis, and yields insights about that relation which are not available otherwise.

Third, the entropy concept provides a tool of quantitative analysis of energetic and material transformations for engineers and managers. It may be used to design industrial production plants or individual components of those such as to maximize their energetic efficiency, and to minimize their environmental impact. Baumgärtner (2003) wrote that "With its rigorous but multifarious character as an analytical tool, its rich set of fruitful applications, and its obvious potential to establish relations between the natural world and purposeful human action, the entropy concept is one of the cornerstones of Ecological Economics".

References

Baumgärtner, S., 2003. Entropy. *Internet Encyclopaedia of Ecological Economics*.

Georgescu-Roegen, N., 1971. *The entropy law and the economic process*. Cambridge, MA: Harvard University Press.

33. Environmental Impact Assessment

Background and definiton

Developed in the mid 1970s, environmental impact assessments (EIA) have been increasingly applied to large and medium-sized development proposals. An EIA is an assessment of the possible impacts – positive or negative – that a proposed project may have on the environment. It refers to both a decision making process and a document. The purpose of the assessment is to ensure that decision makers consider the ensuing environmental impacts when choosing whether or not to proceed with a project. It is meant to provide an opportunity for all stakeholders to participate in the identification of issues of concern, practical alternatives, and to identify opportunities to avoid or mitigate adverse impacts.

The International Association for Impact Assessment (IAIA) defines an EIA as "the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made". After an EIA, the precautionary principle and the

polluter pays principle may be applied to prevent, limit, or require strict liability or insurance coverage to a project, based on its likely harms. It can also culminate in follow-up monitoring and mechanisms to secure compliance with conditions for approval. While there is widespread agreement on basic principles of EIA their application differs internationally, particularly in the degree to which alternatives are assessed, the public involved, and follow up considered as part of the process. Quite often, EIAs are applied after the decision to make a project has been taken, and they have a purely cosmetic character.

The fundamental components

A standard EIA theoretically involves stages (IAIA, 2009):

1. To determine which projects require a full or partial impact assessment study;

2. To identify which potential impacts are relevant to assess (based on legislative requirements, international conventions, expert knowledge and public involvement);

3. To assess and evaluate the likely environmental impacts of the proposed project;

4. To identify alternative solutions that avoid, mitigate or compensate adverse impacts (including the option of not proceeding with the development);

5. Of reporting the Environmental Impact Statement (EIS) or EIA report, including an Environmental Management Plan (EMP) and a non-technical summary for the general audience.

6. To review the EIS through public participation.

7. To make decisions on whether to approve the project or not, and under what conditions;

8. To monitor, comply, enforce and audit, monitoring whether the predicted impacts and proposed mitigation measures occur as defined in the EMP, verifying the compliance of proponents with the EMP, and ensuring that unpredicted impacts or failed mitigation measures are identified and addressed in a timely fashion.

Controversies

EIAs are sometimes controversial. In an example taken from Ecuador (Gerber and Veuthey, 2010), the elaboration and use of the EIA of an industrial eucalyptus plantation turned out to be an eminently political process. The EIA started when the project had already been launched and the final report was kept hidden from local environmental NGOs. The EIA did not specify the exact area and location of the eucalypts. A monitoring plan was not provided, nor was there any civil society participation vehicle as stipulated by the Law. Instead of a real popular consultation, the plantation company organized a kind of electoral campaign within the

neighboring communities, winning over people by making promises, and thereby benefiting from its powerful and comfortable “donor” position. The company promised employment in the plantation and a compensation plan (that included programmes of microfarms and training as well as the installation of drinking water, health centres, sport fields, new roads and computers).

Moreover, there were many irregularities in the environmental management plan: no chronogram of inspections; non-respect of legal minimal distances between the plantation and the bodies of water; and a lack of the necessary information on the social and environmental impacts. All this resulted in a resistance campaign by a grassroots NGO with the support of local peasants against the plantation. This case is far from being an isolated example.

References

Gerber, Julien-François & Sandra Veuthey. 2010. Plantations, resistance, and the greening of the agrarian question in coastal Ecuador. *Journal of Agrarian Change*.

International Association for Impact Assessment (IAIA), 2009. *What is impact assessment?* http://www.iaia.org/publicdocuments/special-publications/What%20is%20IA_web.pdf

34. Environmental (In)justice

Background and definitions

The concept of environmental injustice arose out of recognition that some communities are disproportionately subjected to higher levels of environmental risk than other segments of society. Growing concern over unequal environmental risk and mounting evidence of both racial and economic injustices led to the emergence of a grassroots civil rights campaign for environmental justice in the 1980s in the United States. The concept was taken up by philosophers in the 1990s, and then sociologists, geographers, economists and politicians took interest. Now an international Environmental Justice Movement is flourishing, having emerged out of various struggles, events and social movements worldwide. Linked with environmental justice are the ideas of capabilities, of ecological inequalities and of ecological debt.

The United States Environmental Protection Agency Office of Environmental Justice defined environmental justice as the “the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. It will be achieved when everyone enjoys the same degree of protection from environmental and health hazards and equal access to the decision-making process to have a healthy environment in which to live, learn, and work.” The South African Environmental Justice Networking Forum asserts: “Environmental justice is

about social transformation directed towards meeting basic human needs and enhancing our quality of life – economic quality, health care, housing, human rights, environmental protection, and democracy. In linking environmental and social justice issues the environmental justice approach seeks to challenge the abuse of power which results in poor people having to suffer the effects of environmental damage caused by the greed of others."

Focus

Environmental justice movements focus on the distribution of environmental risks by race, class and gender, and aim at finding equitable ways of distributing the benefits and burdens of economic growth. Root causes of environmental injustices include the distribution of property rights; institutionalized racism; the commodification of land, water, energy and air; unresponsive, unaccountable government policies and regulation; and lack of resources and power in affected communities. Some individuals, groups, and communities are at special risk from environmental threats. This is especially the case for low income persons, the working class, and people of color whose health may be imperilled by lead in their houses, pollution in their neighbourhoods, and hazards in their workplace. The environmental justice perspective unmasks the ethical and political questions of "who gets what, why, and in what amounts", calling for environmental and public health strategies to ensure the equal protection of all citizens, including indigenous peoples who often live at the extractive "commodity frontiers".

North-South environmental justice

Since the end of World War II, industrialized nations have generated increasing volumes of hazardous waste. The amount of toxins produced around the globe has risen exponentially in the last five decades. Today, it is estimated that nearly 3 million tons of hazardous waste from the United States and other industrialized nations cross international borders each year. Of the total volume of hazardous waste produced worldwide, 90% of it originates in industrialized nations. Some of it is being shipped to nations in South America, Southeast Asia, and Africa. There are two principal reasons for this (Pellow *et al.*, 2001): (1) more stringent environmental regulations are emerging in nations in the North, which provides an incentive for polluters to seek disposal sites beyond national borders; and (2) there is a widespread need for money among Third World nations, rooted in a long history of colonialism and contemporary debt arrangements. This leads government officials in Africa, Asia, and South America to accept financial compensation in exchange for permission to dump chemical wastes in their territory despite the provisions of the Basel Treaty against such trade. Observers have described these transactions as "efficient" (Lawrence Summers' principle) while others prefer the terms "toxic colonialism" and "garbage imperialism".

Closing remarks

Focusing on activism and policy-making, Pellow *et al.* (2001) emphasize the following key points that must be addressed in understanding and leading

environmental justice movements. These authors also point out that these four factors may equally help legislators in their rule-making.

- The importance of the *history* of environmental inequalities and the processes by which they unfold. The fact that the future, rather than history, seems to drive environmental activism and policy-making is a grave mistake and often serves to undermine the very intention of legislation predicated on advancing society, without taking into account longstanding traditions, tensions, and institutions.

- The role of social stratification by *race* and *class*, given the fact that the poor and people of colour are generally the most vulnerable to environmental inequalities. However, it must be kept in mind that communities and racial groups are frequently divided, creating intraracial and intracommunity conflicts, often along class lines. This fact is addressed in the subsequent point.

- The role of *multiple stakeholders* in these conflicts. The role of women leaders is noticeable in many environmental justice conflicts worldwide.

- The ability of those least powerful segments of society to shape the contours of environmental justice struggles. Environmental injustices are thus "works in progress"; as resistance is ongoing.

References

Bullard, R.D., 1994. Unequal protection: environmental justice and communities of color. Random House.

Pellow, D.N., A. Weinberg and A. Schnaiberg. 2001. The Environmental Justice Movement: Equitable Allocation of the Costs and Benefits of Environmental Management Outcomes. *Social Justice Research*, 14 (4): 423-439.

Websites

http://www.ejfoundation.org/

http://www.ejnet.org/ej/

http://www.fhwa.dot.gov/environment/ej2.htm

35. The Environmentalism of the Poor

Origins

Theories of "environmentalism of the poor" (Guha and Martinez-Alier, 1997; Guha, 2000; Martinez-Alier, 2002) and "liberation ecology" (Peet and Watts, 2004) have much in common with the branch of the Green movement that contests the unequal distribution of ecological goods and evils resulting from economic growth. These perspectives are distinct from the mainstream current of environmentalism seeking ecological modernization and eco-efficiency, and also from the older

environmentalist current aimed at conserving a pristine nature without human interference. Movements born of environmentalism of the poor also tend to find their home in 'Third World' countries, or those of the global South, in contrast to "environmental justice" movements which are mainly found in Northern regions.

Examples: Current and Historical

The environmentalism of the poor manifests itself though conflicts that have an ecological element, including social justice claims and involving impoverished populations struggling against the state or against private companies that threaten their livelihood, health, culture, autonomy. These movements are born from the resistance (expressed in many different languages) against the disproportionate use of environmental resources and services by the rich and powerful. Ordinary women and men strive to correct the wrongs that have been committed against the land, water and air around them. In so doing, they contradict the Brundtland report and its view that environmental damage is caused by poverty. Ecological anthropology, agro-ecology and political ecology are the main academic allies of the environmentalism of the poor. The Chipko movement in India, and the movement of the *seringueiros* linked to Chico Mendes during the second half of the 20th century arguably represent two of the most emblematic cases of environmentalism of the poor.

There are many well known contemporary examples of this type of environmentalism: the Ogoni, the Ijaw and other groups protesting the damage from oil extraction by Shell in the Niger Delta; resistance against eucalyptus in Thailand and elsewhere on the grounds that "plantations are not forests"; the movements of oustees due to dam construction as in the Narmada river in India and the *atingidos por barragens* in Brazil; and the new peasant movements such as *Via Campesina*, against agro-industries and biopiracy (biopiracy refers to the appropriation of knowledge of agricultural or medicinal plants without payment, essentially theft). There are also many historical instances of what could be termed the environmentalism of the poor, although the words 'ecology' and 'environment' were not used politically at the time and the actors of such conflicts rarely saw themselves as 'environmentalists', concerned mainly with livelihood. Two examples related to copper mining come from Rio Tinto, Andalusia in the 1880s against sulphur dioxide; and in the early 1900s against the pollution of the Watarase river by the Ashio copper mine in Japan.

A Growing Movement

As long as problems related to the unequal distribution of ecological costs and benefits remain unaddressed, efforts to pacify protagonists of this type of movement are unlikely to succeed. On the contrary, the publicity given to these struggles through traditional channels of communication and today's "network society" is a source of inspiration to others opposing forces bent on destroying local and global environments. Ultimately, the sum of these conflicts may represent a powerful social force for greater sustainability.

References

Guha, R., 2000. *Environmentalism: a global history*. Oxford: Oxford University Press.

Guha, R. & Martínez-Alier, J., 1997. *Varieties of environmentalism: essays North and South*. London: Earthscan.

Martínez-Alier, J., 2002. *The environmentalism of the poor: a study of ecological conflicts and valuation*. Cheltenham: Edward Elgar.

Peet, R. & Watts, M. (eds.), 2004. *Liberation ecologies*. New York: Routledge.

36. EROI (Net Energy Analysis)

Introduction and Definition

EROI (*Energy return on investment)* is an analytic tool for the evaluation of energy systems, that seeks to compare the amount of energy delivered to society by a technology to the total energy required to find, extract, process, deliver, and otherwise upgrade that energy to a socially useful form. The acronym was introduced by Charles Hall. EROI is expressed as the ratio of energy delivered to energy costs. For instance, energy from the Alberta tar sands in Canada or energy from so-called biofuels is very expensive to produce in terms of energy, as the energy surplus obtained is relatively small. To calculate the energy cost of energy, or

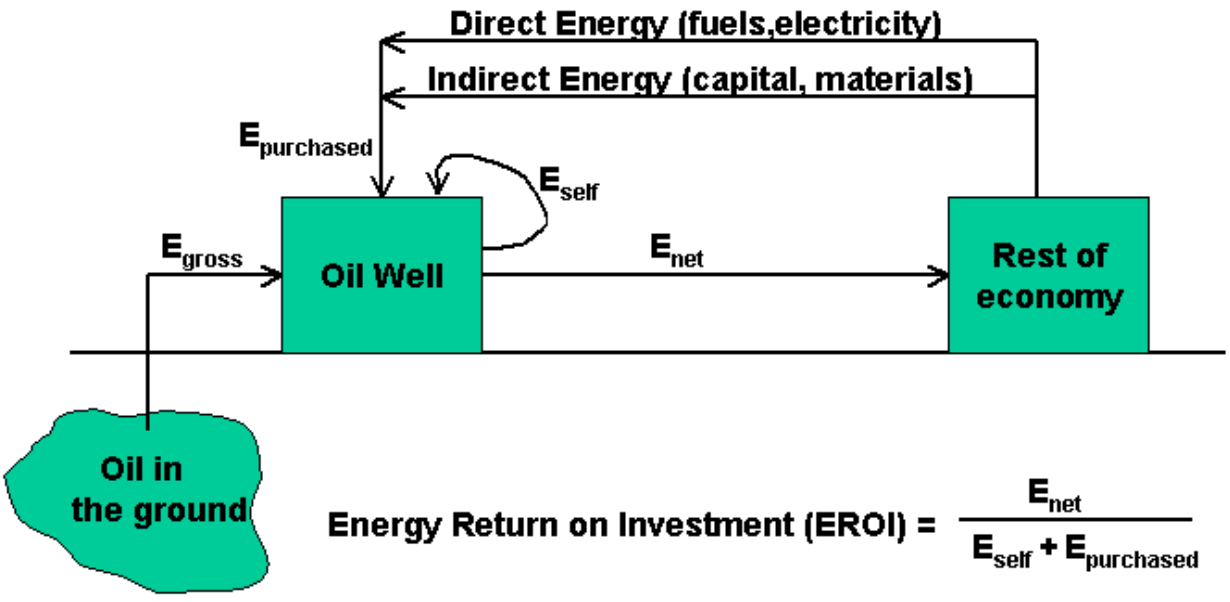


Figure 1: Energy Return on Investment (EROI):
(Source: Cleveland, 2008)

any good or service, one must be able to quantify in energy terms the fuel, capital, materials, and labor used in the extraction and processing of the energy in question. *EROI* calculations are market-determined to the degree that they depend on the technology, industry structure, discount rate, and prices that exist at the time. Changes in any of those factors will alter the energy costs of goods, and thereby alter the results of net energy analysis (Cleveland 2008).

Net energy analysis seeks to assess the direct and indirect energy required to produce a unit of energy. Direct energy is the fuel or electricity used directly in the extraction or generation of a unit of energy. An example is the natural gas burned in engines that pump oil to the surface. Indirect energy is the energy used elsewhere in the economy to produce the goods and services used to extract or generate energy. An example of this is the energy used to manufacture the drilling rig used to find oil. The direct and indirect energy use is called “embodied” energy (Cleveland, 2008) although in actual fact it is energy that has been spent, dissipated.

Debate

Many economists view net energy analysis as yet another physical model of scarcity which, like the classical economic scarcity model and *The Limits to Growth* physical models, they see as inferior to the neoclassical view of scarcity. Some energy analysts, such as Odum, Hannon, and Costanza, proposed in the early 1970s a theory of economic and social value based on energy, which economists were quick to criticize (Cleveland, 2008).

Contrary to other economists, ecological economists argue that net energy analysis does not provide a theory of value but it has several advantages over standard economic analysis: (1) It assesses the change in the physical scarcity of energy resources, it shows the increasing energy costs of obtaining energy; (2) because goods and services are produced from the conversion of energy into useful work, net energy is a measure of the potential to do useful work in economic systems and (3) EROI can be used to rank alternative energy supply technologies according to their potential abilities to do useful work in the economy.

A good historical work using EROI is Hall et al. (1986). To Cleveland himself, “EROI emphasizes the physical underpinnings of scarcity, while acknowledging the importance of economic factors. It implicitly assumes that changes in the energy cost of energy have important economic implications that may or may not be reflected in prices.” Further, economic significance of the EROI to him “does not hinge on the existence or nonexistence of a causal link between changes in the EROI and changes in the structure and direction of change in the economy” in the sense of some form of "energetic determinism", and social and cultural factors too merit consideration” (Cleveland, 2008). The fact is that economic growth will be slowed down as we enter a period of decreasing EROI, that is, of increasing energy costs of obtaining energy. For instance, getting oil as we go down the Hubbert curve (after peak-oil) will very likely require increasing amounts of energy as the oil is to be found

in remote places or at great depth under the sea.

References

Cleveland, C. (Lead Author), Costanza, R. (Topic Editor). 2008. "Net energy analysis." In: Encyclopedia of Earth. Eds. Cutler J. Cleveland [Online] URL: http://www.eoearth.org/article/Net_energy_analysis [First published in the Encyclopedia of Earth September 14, 2006; Last revised August 22, 2008; Last viewed November 11, 2009. Environmental Information Coalition, National Council for Science and the Environment, Washington, D.C.

Hall, C.A.S., Cleveland, C.J., Kaufmann, R.K. (Eds.) 1986. Energy and Resource Quality, The Ecology of the Economic Process. Wiley-Interscience, New York.

37. Externalities

Basic definition

Social costs – or externalities – are harmful effects and inefficiencies that are not internalized in the production costs of enterprises. Therefore, market prices do not include externalities. The first analyses of externalities were made by the Cambridge economist, Arthur C. Pigou, in the 1920s.

In order to be recognized as social costs, externalities must have two characteristics: (1) it must be possible to avoid them; and (2) they must be part of the course of productive activities and be *shifted* to third persons or the community at large (Kapp, 1963). Pollution, for instance, can be traced to productive activities and can be shown to be human-made and avoidable.

As the great ecological and institutional economist K.W. Kapp (1969) argued, “the basic causes of social costs are to be found in the fact that the pursuit of private gain places a premium on the minimization of the private costs of current production. Therefore, the greater the reliance on private incentives, the greater the probability of social costs. The more reliance an economic system places on private incentives and the pursuit of private gain, the greater the danger that it will give rise to external ‘unpaid’ social costs unless appropriate measures are taken to avoid or at least minimize these costs”.

37.1 Cost-shifting

By shifting part of the costs of production to third persons or to the community at large, producers are able to appropriate a larger share of the natural product than they would otherwise be able to do. Alternatively, it may be claimed that consumers who purchase the products will get them at lower prices than they would have been able to do had producers been forced to pay the total costs of production. The fact

that social costs raise issues of income redistribution makes them matters of political controversy and power relations.

The example of North-South trade

Environmental problems associated with trade of natural resources include ecosystem destruction, biodiversity loss, and land, water and air pollution. Worsening terms of trade prevent internalisation of these social and environmental externalities. In this sense, countries specialised in extraction activities where commodity prices tend to fall over time tend to have fewer opportunities to internalise environmental costs into prices. Moreover, private sector practices, such as transfer pricing, can make the situation even worse. If international conditions determining prices make the South less able to internalise externalities, then there is a transfer of wealth from poor countries to rich countries, or, in other words, the North is transferring environmental costs to poor countries. This mechanism is referred to as ecologically unequal exchange.

While neoclassical economics looks at environmental impacts in terms of externalities which should be internalized into the price system, ecological economists see externalities – following Kapp – not as 'market failures' but as 'cost-shifting successes' allowed by social asymmetries in the distribution of property rights, income and power (Martinez-Alier and O'Connor, 1999). Under the Suharto regime in Indonesia for instance, mining and plantation companies expanded on a massive scale at the expense of local peasant and indigenous populations, often protected by military forces. As Martinez-Alier has put it (2001): "It would be a cruel joke to say that a suitable environmental policy (implementing the "polluter pays principle") would have allowed externalities to be internalized into the price of exported copper and gold. Environmental economists forget to include the distribution of political power in their analysis. Some of them even believe in their touching innocence that environmental damages arise because of 'missing markets'".

Alternative Approaches

Such cost-shifting gives rise to environmental movements manifesting themselves in local and global conflicts. These movements employ a variety of languages and strategies of resistance, and they cannot be gagged by cost benefit analysis. For policy, what is needed is not cost-benefit analysis but rather a non-compensatory multi-criteria approach able to accommodate a plurality of incommensurable values.

References

Kapp, K.W., 1963. *Social costs of business enterprise*. Second enlarged edition. Bombay/London: Asia Publishing House.

Kapp, K.W., 1969. On the nature and significance of social costs. *Kyklos*, XXII(2): 334-347.

Martinez-Alier, J., 2001. Mining conflicts, environmental justice, and valuation. *Journal of Hazardous Materials*, 86: 153-170.

Martinez-Alier, J., and M. O'Connor, 1999. Distributional issues: an overview. In: J. Van den Bergh (ed.), *Handbook of environmental and resource economics*. Cheltenham: Edward Elgar.

38. Extractive Periphery

Trade and Growth

According to economic theory, the basis for international trade is the existence of inter-regional differences in endowments of natural resources (and therefore raw materials), technology and climatic conditions. Hence, trade widens the growth potential of nations by making resources available that are not locally based and making produce marketable for which local demand would be too low. According to classical understanding (see Smith, 1776; Ricardo, 1817; Innis, 1930; Heckscher 1919, Ohlin 1933) trade would lead to a situation in which all economies would finally gain advantages (Eisenmenger et al., 2007).

Core - Periphery Perspectives

During the 1950s and 1960s however, economists were already discerning diverging national pathways to industrialization, even where countries departed from similar starting points, with new theories evolving to explain why this should be the case (Eisenmenger et al., 2007) These drew upon new applications of theoretical concepts of 'imperialism' (see e.g. Baran, 1975 and Mandel, 1968), 'dependency theory' (Prebisch 1950; 1959), and the 'world systems perspective' (e.g. Amin 1976, Wallerstein 1979). According to these approaches, in the existing world system, *peripheral countries* specialize in the production of primary commodities such as raw minerals and agricultural products that are less technologically sophisticated, are more labour-intensive and exposed to severe competition on world markets, thus leading to low prices and low surplus. Primary products from these *extractive peripheries* are then exported to industrialized *cores*, which are characterized by a high level of capital accumulation and complex production activities (Eisenmenger et al., 2007). Here production is based on advanced technologies, highly mechanized production structures and higher wages. *Industrial* cores then sell their high-tech and capital-intensive products to the *peripheral countries* (Eisenmenger et al., 2007).

This exchange on world markets leads to an outflow of surplus from the *periphery* to *the core* due to the fact that: "*Peripheral countries* specialize in exports of agricultural products and raw materials, where they are confronted with an increasing competition from other developing countries, which forces them to reduce prices to keep export revenues. This leads to a worsening in the terms of trade, and *they* have to export ever more goods in order to obtain the same revenues to support the

imports needed (Eisenmenger et al., 2007) Secondly, low salaries are found in the periphery due to the massive 'reserve army' of labour generated through technological progress in agriculture (Eisenmenger et al., 2007). Revenues from increased efficiency thus result in lower prices of exports instead of increased income for workers (Emmanuel 1972). Economic development in the periphery is therefore complementary to economic development in the centre. Specialization in exports of raw materials, in the medium and long run, supports underdevelopment in the periphery and development in the centre. Even worse, the specialization in exporting raw materials leads to a depletion of domestic natural resources by selling out the domestic resource base (Eisenmenger et al., 2007).

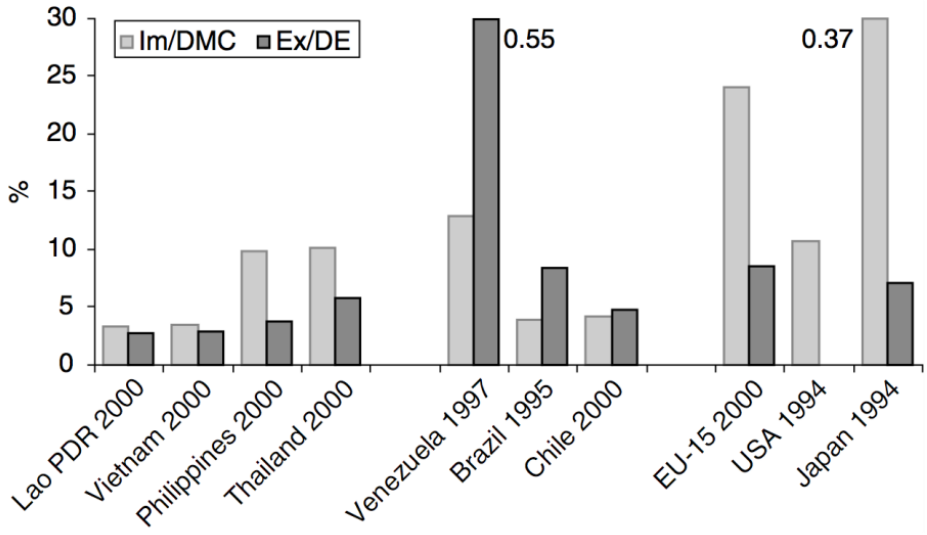


Figure 1: Trade intensities:
Imports in proportion to Domestic Extraction and to Domestic Material Consumption in tons
(Source: Eisenmenger et al. (2007)

Figure 1 shows the relation of imports to domestic consumption (in tons) (DC) and exports to domestic extraction (in tons) (DE) for *core* and *peripheral or semi-peripheral* countries. Whereas in Venezuela a huge amount of domestic extraction is exported, Japan relies to large extent on imports for domestic consumption. Notice also that Chile's exports do not take into account the "ecological rucksacks" of mining.

38.1 World Systems Analysis

So how did this 'economic world order' originate? According to Wallerstein's "world-systems analysis" the coincidence of an extended feudal crisis leading to growing class conflict, a pronounced cyclical economic downturn, and serious climatological difficulties led the ruling classes of late medieval western Europe to seek a solution to their diverse problems in foreign territorial and commercial expansion. But besides

permitting the elites to perpetuate their sway at home, these policies quite unintentionally established a new economic order founded on a world-wide division of labor and political units of disparate strength. In the course of a century, a tripartite system of *core*, *semiperiphery* and periphery emerged and became firmly integrated and self-perpetuating through unequal exchange in the market (DuPlessis, 1988).

DuPlessis (1988) adds that the northwestern European core of Holland, England and northern France were the strongest states, with the most profitable economic activities and most efficient forms of labor control, allowing this area continually to skim off the bulk of the economic surplus generated elsewhere and thereby reinforce its superiority. In stark contrast, the *periphery* (Latin America, Eastern Europe and much of the Mediterranean basin) was deficient in every respect, but its grain, bullion and raw materials, produced inexpensively, provided the resources that permitted the core both to specialize in more lucrative activities and to exploit the periphery ruthlessly and thoroughly. The *semiperiphery*, comprising the remainder of western and southern Europe, along with portions of central Europe and British North America, was intermediate in political structure and power, economic activities, modes of labor domination, and destiny. During the seventeenth century, some segments managed to move toward core status, while others fell into the periphery, but despite these shifts and others within the other two zones, neither the overall structure nor the dynamics of the world-system changed after the sixteenth century.

To DuPlessis the focal point of Wallerstein's work is the rise and elaboration of capitalism, a project that seeks to elucidate the means by which a system of production of goods for exchange in the market became hegemonic over much of the globe. Although Wallerstein situates capitalism's center in Western Europe, DuPlessis says, “he conceives of it not as having been initially articulated there and subsequently diffused over much of the rest of the earth, but as worldwide from the start.” Wallerstein denies the view existing among many Marxists that much of the "Third World" remained feudal until very recently and is only now undergoing the transition to capitalism. In his interpretation, even the most backward lands have long been part of the world economy, which has been wholly capitalist and inherently unequal since its inception in the sixteenth century (DuPlessis, 1998).

References

DuPlessis, R., S. (1988): Wallerstein, World Systems Analysis, and Early Modem European History. The History Teacher 2 (2), pp. 222-232

Eisenmenger, N., Ramos Martin, J. and Schandl, H.(2007): Transition in a contemporary context: patterns of development in a globalizing world . In : M. Fischer-Kowalski and H. Haberl (Editors), Socioecological Transitions and Global Change. Trajectories of Social Metabolism and Land Use. Edward Elgar,Cheltenham, UK and Northampton, USA, pp. 179 -222.

39. Fair Trade

Concept

Fair Trade today is a global movement, with thousands of small-scale producers and workers in over 50 countries in the South organized in partnerships with NGOs from the North to trade fair coffee, tea, chocolate, fruit juice, rice, etc. This movement aims at raising awareness in the North and offering Southern producers improved terms of trade along the principle of justice and the objective of development.

What is Fair Trade?

Many different definitions of Fair Trade can be found among the myriad of NGOs, cooperatives, and world shops busy with this issue of global justice. However, in 2001, a common definition was agreed on by the main Fair Trade networks: *Fairtrade Labelling Organisations International* (FLO); *International Federation for Alternative Trade* (IFAT; now WFTO); *European Fair Trade Association* (EFTA); and *Network of European World Shops* (NEWS!). Since then, the definition below has been recognized by the European Parliament (2006), the European Economic and Social Committee (2009) and the European Commission (2009):

"*Fair Trade is a trading partnership, based on dialogue, transparency and respect, that seeks greater equity in international trade. It contributes to sustainable development by offering better trading conditions to, and securing the rights of, marginalized producers and workers – especially in the South. Fair Trade Organizations, backed by consumers, are engaged actively in supporting producers, awareness raising and in campaigning for changes in the rules and practice of conventional international trade*."

Fair Trade is also a product label with a certification system conceived as an independent guarantee to consumers of the distinctive quality of the products they buy. The Fairtrade certification system is run by a separate company (FLO-CERT), which checks compliance with Fair Trade standards, which stipulate for example. that companies trading Fair Trade products must:

- Pay a price to producers that aims at covering the costs of sustainable production: the Fairtrade Minimum Price.
- Pay an additional sum that producers can invest in development: the Fairtrade Premium.
- Partially pay in advance, when producers ask for it.
- Sign contracts that allow for long-term planning and sustainable production practices

Historical overview

The philosophical principles underlying the concept can be traced back to Aristotle (and his ideas of justice, equity and goodness), but the concept as it is known now

first appeared after WWII in the USA, with the 'Ten Thousand Villages' (formerly Self Help Crafts) project in the late 1940s, and then with Oxfam UK in the late 1950s, when Oxford students introduced the sale of crafts made by Chinese refugees in Oxfam shops. In 1964 Oxfam created the first Fair Trade Organization, but parallel initiatives were taking place in the Netherlands, notably with the message "*by buying cane sugar you give people in poor countries a place in the sun of prosperity*".Networks of engaged citizens have been crucial in the constitution of the Fair Trade movement, working as volunteers in Fair Trade shops in order not only to diffuse products but also ideas.

The second UNCTAD conference (United Nations Conference on Trade and Development) in Delhi in 1968 was crucial in enabling developing countries to bring the debate to an international political forum with the motto "Trade not Aid", adding equity to the international agenda.

From the 1960s onward, Fair Trade became associated with objectives of economic and social development: at a micro scale, aiming to provide a supplementary income to families, and at a global scale, to make international trade fairer and make mainstream business more aware of its social and (later) environmental responsibility. In the 1980s, the idea of the Fair Trade label was conceived by a Dutch church-based NGO, leading in 1988 to the "Max Havelaar" label in The Netherlands. Within a year this label had managed to secure a 2 percent market share for its labeled coffee, and similar non-profit Fair Trade labelling organizations flourished. In 1997, some order was introduced with international standards and a certification process agreed by the Fairtrade Labelling Organisation (FLO). Labeling and certification has brought Fair Trade to mainstream business, as: *"Currently, over two-thirds of Fair Trade products are sold by mainstream catering and retailing."*

Challenges ahead

From its origins, this movement has aimed to redistribute incomes from Northern consumers to producers of the South, and to question and raise awareness of mainstream models of development and globalization in the North and South. The current challenges of Fair Trade are to couple a wide diffusion of the concept, a certification system and the selling of Fair Trade products through conventional distribution networks with these initial principles of education and advocacy.

Indeed, mainstreaming Fair Trade product into large-scale distribution has led to an increase of market share which benefits to southern producers. However, this was also synonym of a focus on the logic of consumption rather than of civic coordination. Further, it has turned Fair Trade into a genuine market niche leading to clear risk of Fair Trade "*being re-absorbed by the market and captured by dominant actors of the food system*" (Renard, 2003). The danger could come from the institutionalization process itself, and its tendency to minimize social and environmental requirements towards the minimum consensus. To avoid this, the

certification procedure has to keep standards high and the Fair Trade labels have to remain the symbol of moral values associated to the specific social interactions on which Fair Trade was built and which legitimize it. It is also worth mentioning that many essential bulk commodities traveling from South to North (oil, gas, copper, iron ore…) are not included in Fair Trade circuits.

References

Goodman, Michael K. (2004), Reading fair trade: political ecological imaginary and the moral economy of fair trade, *Political Geography*, vol. 23, pp. 891-915

Malo, Marie-Claire, Audebrand, Luc K., Camus, Annie, Legault-Tremblay, Pierre-Olivier (2009) Le processus d'institutionnalisation du commerce équitable, CRISES. Collection Études théoriques, n° ET0905, 16p.

Marlike Kocken, Sixty Years of Fair Trade. A brief history of the Fair Trade movement, EFTA, 6p. (last update: November 2006), http://www.european-fair-trade-association.org/efta/library.php

Renard, Marie-Christine, 2003, Fair trade: quality, market and conventions, *Journal of Rural Studies*, vol. 19, pp. 87-96

Websites:

http://fairtrade-advocacy.org

http://www.european-fair-trade-association.org

http://www.maketradefair.com

40. Forest Economics

Definition

Analogous to a basic definition of economics, forest economics is defined as a science of allocation of scarce resources among competing means to satisfy human (consumers) wants and needs for forest products (Gregory, 1987). With roots in conventional neoclassical economics, this applied science combines principles of forestry and economics to issues such as pricing, buying, selling, ownership and tenure, taxation and management of forest resources (wood, wildlife, medicinal herbs, water provision, etc) and forest lands. It is mainly focused on sustained yield timber management, resource extraction and commodity production, excluding a wide range of forest values (ecological, aesthetic, spiritual, etc). The forest is viewed

as a storable renewable resource and forestry as a capital-demanding field of investment with long rotation (production) periods and easily measurable stock growth.

Application

Trees grow according to the logistic function or Verhulst curve, that is, they grow quickly at the beginning, and then more slowly. The private owner of a forest (or rather, of a tree plantation) who wants to maximize its profits, thus compares a) how much (s)he will earn by delaying by one year the cutting and selling of the trees, to b), how much (s)he will earn by cutting and selling the trees today and putting the money in the bank for one year. The higher the rate of interest (or equivalently, the higher the discount rate), the more inclined (s)he will be to shorten the rotation period.

We could compare this to Hotelling's rule in oil extraction economics, where a high discount rate or interest rate implies selling faster the oil stock. Here the resource does not grow. There is a fixed stock of oil produced by photosynthesis millions of years ago. The profit mazimizing owner of an oil well (who follows neoclassical economics) will compare how much he makes by leaving oil in the ground or by taking the oil out. If he takes and sells the marginal barrel, he earns now the interest that the bank will pay on the difference between price and extraction cost. If he leaves oil in the ground, he earns the discounted value of the future revenue (again future price minus extraction cost). If the discount rate or interest rate is high, he will sell the oil quickly.

Returning to forest economics, here the resource itself is growing. One of the most basic and well-known solutions for the single stand rotation problem is found in the Faustmann Rule. This is a model that is used to calculate the ideal rotation period with an infinite time horizon when forest management consists in determining the moment for clear-cutting. You cut the trees, and start again another rotation period. Should you cut often or rather wait while the trees are still growing a little? The model computes the age at which an even-aged forest stand (plantation) should be harvested in order to maximize the return to forestry (Touza-Montero & Termansen, 2001). It focuses on the age-class structure of forest stands assuming all rotations of land are identical (Touza-Montero & Termansen, 2001). According to this rule, the optimal time to harvest a standing forest is when the marginal benefits of delaying the harvest equal the opportunity costs of waiting. In fact, Faustmann explained that "economic optimal rotation is less than the rotation that produces the maximum average annual biological yield" since forest cutting means income from timber and also, moreover, some income from the land now free of trees (for pastures, for instance, while the trees start to grow again) (Raunikar & Buongiorno, 2007). The price of the product is the key input for this principle that considers only timber products.

Inclusion of non-timber values

Hartman (1976) reviewed Faustmann's rule, addressing the importance of the non-timber values in the Faustmann's rotation solution, taking into account "the additional flow of amenity outputs if the harvest is delayed" (Touza-Montero & Termansen, 2001). The non-timber values of mature forests are, for example, flood and erosion control, wildlife and clean water provision, carbon sequestration, recreation, and many others. According to Hartman's rule, if these services are more valuable than those of a new plantation, the harvest age should be extended. When is then the optimum moment to cut the trees? Perhaps never.

Implications/Issues

Using the principles of classical Forest Economics, conventional forest management (CFM) leads to timber exploitation focusing on profit rather than on sustainable management practices, having negative impacts on biodiversity and provision of ecosystem services. Sustainable Forest Management (SFM) in contrast, is a new paradigm with broader social, economical and environmental goals, taking an ecosystem approach that recognizes multiple forest values, to achieve balance between societal demand for forest products and protection of the forests (Forest Europe, 2009).

References:

European Forest Institute (n.d) Introduction to Forestry, Forest Policy and Economics. An open interactive Learning Source. http://foper.unu.edu/course/ Accessed March/2010

FOREST EUROPE (The Ministerial Conference on the Protection of Forests in Europe) Sustainable Forest Management. Available at http://www.foresteurope.org/eng/What_we_work_for/Sustainable_Forest_Management/ Accessed March/2010

Gregory, R.G. (1987) Resource Economics for Foresters. John Wiley & Sons, Inc. New York.

Touza-Montero, J., Termansen, M. (2001) The Faustmann Model as a Special Case. Workshop 2001: Conservation and Sustainable Development-Comparative Perspectives, Yale Center for Comparative Research

Raunikar, R., Buongiorno, J. (2007) Forestry Economics: Historical Background and Current Issues in Weintraub, A., Romero, C., Bjørndal, T., Epstein, R. (Eds.) (2007) Handbook Of Operations Research In Natural Resources. Springer, US

Wang, S. (2004) One hundred faces of sustainable forest management. Forest policy and Economics. 6 3-4. pp. 205-213

41. Funds and Stocks

Background: Natural resources are not homogeneous

While conventional economics tries to approach natural resources through monetary means, ecological economics stresses the need to make the biogeochemical characteristics of resources explicit. This allows for a distinction between the ecological and economic potential of resources, with respect to growth and sustainability for instance. Given the radically different characteristics of resources, erroneous conclusions tend to be drawn when they are conceptualized as undifferentiated “natural resources”.

Nicholas Georgescu-Roegen (1971), one of the founders of ecological economics, proposed a fundamental distinction between funds and stocks of natural resources:

- *Funds*, such as wood or fish, built up and maintained by solar radiation are able to renew themselves and provide both ecological and economic *services*, as long as the conditions necessary for their renewal are met. Funds correspond to renewable resources.
- *Stocks*, such as oil or copper, constitute limited reservoirs of organised matter and mineralised energy resulting from biogeochemical processes on a geological and not a historical time scale, but from which it is possible to extract flows of energy-matter. These flows can only be exploited for a relatively short period of human history, leaving stocks depleted and the environment degraded by their dissipation of energy-matter. Stocks correspond to non-renewable resources.

Distinguishing unequal economic potentials

This distinction between funds and stocks sheds light on their different economic potentials (Georgescu-Roegen, 1971; Steppacher and van Griethuysen, 2008). The growth potential of living or biotic resources – funds – is naturally limited and therefore cannot fuel exponential economic growth. However, the limited capacity of biotic resources to supply economic growth is compensated for by the quality of being renewable. The lesson is: *limited growth yet potentially sustainable.*

The case of non-renewable mineral resources – stocks – is quite different. Since the industrial revolution, mineral resources have been capable of inducing exponential growth: stocks of energy-matter can be used to develop machines and motors that allow an even quicker exploitation of stocks. However, as the process quickens, stocks get irreversibly depleted at an increasing pace while natural assimilation

capacities are overloaded. Fuelled by the limited stock of mineral resources in a limited natural environment, exponential economic growth is inexorably limited to a given historical period. The lesson is: *exponential growth without sustainability*.

The distinction between services of funds and flows of stocks highlights the specific *temporal characteristics* of different natural resources. Given that biotic resources depend on ecological reproductive cycles, the availability of their services is subject to the natural calendar. It is therefore not possible to exploit these funds (land, labour and equipment) to their full capacity. That is why economic activities in traditional agrarian economies are diversified and organised in accordance with the cyclical rhythms of nature. On the other hand, the flow of mineral resources from stocks does allow continuous productive activity. This characteristic which reduces costs and makes specialisation possible is an essential element of industrial production.

Conclusion

Given the institutionalised growth dependency of western civilisation, it is not surprising that nearly all technological progress over the last 150 years has been based on the substitution of renewable by non-renewable resources, in industry, agriculture and services alike. Modern agriculture now uses fossil fuels energy to a great extent, so that if we make the balance between energy output and energy input in the agricultural and food system of industrial countries, we have a declining EROI. An activity that was sustainable is now unsustainable. In such a context, an undifferentiated concept of natural resources is highly problematic owing to the fact that the per capita consumption of fossil fuels mineral resources is very unequally distributed. This failure to differentiate hides the economic privilege that goes with control over mineral resources and fossil fuels (in rich industrialized countries) as well as the particular difficulties that are inherent in the use of biotic and other renewable resources, particularly in combination with high population growth (in poor agricultural countries).

References

Georgescu-Roegen, N., 1971. *The entropy law and the economic process*. Cambridge, MA: Harvard University Press.

Steppacher R and P. van Griethuysen, 2008. The differences between biotic and mineral resources and their implications for the conservation-climate debate. *Policy Matters*, 6: 30–7.

42. GDP Accounting and Critiques

Definition and methods

Macroeconomic accounting establishes the size of the economy by measuring the Gross Domestic Product. It is called “gross” because the depreciation and

amortization of capital (deduction of capital expenses over a period if time) has not yet been deducted from it, to yield the National Income. There are three ways of calculating GDP, and all yield the same final number. The first way is to calculate the sum of all revenues or incomes in the economy, wages plus firms' profits plus land rents. The second is to calculate the total expenditures, in consumption and investment. The third method is to count the sum of all "values added" in the economy, that is the market sales of goods and services minus the costs. When we allow, as we must, for the existence of government, we include its expenditures that are financed by taxes on incomes or on sales. But notice that one could calculate the GDP of a state-less economy (or with a state consisting only of one GDP accountant). The GDP must not be confused with the government budget. There are very small differences between the GDP and the GNP (Gross National Product) that do not concern us here.

Well known deficiencies

There have been many critiques against GDP accounting from the environmental point of view. As recently as the September 2009 President Nicolas Sarkozy addressed the French national statistics agency on the adequacy of GDP in measuring a country's economic well-being. Backed by the report of a commission including Nobel Prize economists Amartya Sen and Joseph Stiglitz, he requested that the agency give greater consideration to factors such as quality of life and the environment (versus solely relying on GDP's reporting of goods and services marketed) in determining the nation's overall "health". In fact, Sarkozy should have referred to previous critiques of national income accounting by the early ecological economists Georgescu-Roegen 1971, Roefie Hueting, 1980, Herman Daly, 1973, René Passet, 1979. Even more disgraceful was not to quote Sicco Mansholt, a president of the European Commission who in 1972 wanted to debate GDP growth. Acknowledging the critiques against GDP from the 1960s and 1970s is a matter of intellectual honesty. It also reinforces today's arguments because one cannot attribute the critique of GDP only to sour grapes in the economic crisis of 2008-09.

Eco-feminist economists (Marilyn Waring, *Counting for nothing*, 1988) have long insisted on the fact that unpaid work (domestic and voluntary work) comprising a large number of hours is not included in the GDP. As Julie Nelson writes in *Ecological Economics* (69, 2009): "One would search in vain in the most paradigmatic models of economics for any inkling of where the materials used in production came from, or where the detritus from the production process goes. Similarly, one would search in vain … for a discussion of where economic agents come from, or where they go (and who takes care of them) when they are broken or used up". In other words, economic accounting focuses on production for the market. It forgets the costs of social and environmental reproduction. Along these lines, Jeroen van den Bergh, a leading ecological economist, recently authored an article (its initial title was "Abolishing GDP") trying to explain why despite "all theoretically

and empirically motivated criticism of GDP as a social welfare and progress indicator, its role in economics, public policy, politics and society continues to be influential".

Because of the economic crisis of 2008-09, in many countries some economic indicators are deteriorating, some environmental indicators improving, and some social indicators improving while others are deteriorating. These should not be added up into a single index. The Human Development Index takes into account social factors apart from GDP but it does not take into account environmental damages. It also correlates closely with GDP. A single convincing economic-social-environmental index does not exist. Therefore what is needed is a "political downgrading" of GDP, and the introduction of participatory multi-criteria assessments to judge where the macro-economy is going.

Reference

J. van den Bergh, The GDP Paradox, *Journal of Economic Psychology*, 30(2), 117-135, 2009.

43. GDP of the Poor

Introduction: GDP and the environment in developing countries

Standard GDP (gross domestic product) statistics are unable to take into account the real livelihood basis of many poor sectors of the world population, nor environmental liabilities and degradation. Different ways of correcting this have been proposed (see a review in Common and Stagl, 2005: chap. 5). In fact, the economic importance of biodiversity and ecosystem services does not figure in the GDP accounting and the real costs of depletion or degradation of natural capital (e.g. water availability, water quality, forest biomass, soil fertility, topsoil, inclement micro-climates, etc) are not recorded in GDP statistics although they are crucial for many people. Sukhdev (2009) (with H. Gundimeda and P. Kumar) has argued that the contribution of natural resources and ecosystem services to livelihoods and well-being should be estimated and recognized, through what they called the "GDP of the poor". The GDP of the poor encompasses all these sectors (forest, water, soil, etc.) from which much of the developing world's poor draw directly their livelihood and employment. Rich people depend on the environment more than poor people – they use more resources and they use the sinks to a greater extent. But rural poor people use (and know) the environment in a more direct way. It is not surprising that they so often complain when they lose access to land and water to mining companies or tree plantations.

Impacts on the poor

The impacts of ecosystem degradation and biodiversity loss mostly affect that proportion of the GDP that can be termed "GDP of the poor". Indeed, poor people

usually are hit hardest by the misuse of environmental resources as they depend on them most heavily. A recent attempt by the NGO the Green Indian States Trust (GIST) to develop the "GDP of the poor" in India provides a good illustration. The NGO showed that although the value of forest services such as fresh water, soil nutrients and non-timber forest products was only around 7% of national GDP (when it was given a money value), it amounted to some 57% of the income of India's rural poor people (see **Fig. 1**).

There are many calls for changes to the current economic paradigm to solve this problem of declining public goods crucial for the poor. One is through TEEB (the Economics of Ecosystems and Biodiversity), a global study that aims to draw attention to the tangible benefits of biodiversity, and to highlight the growing costs of biodiversity loss and ecosystem degradation. Despite this praiseworthy effort to

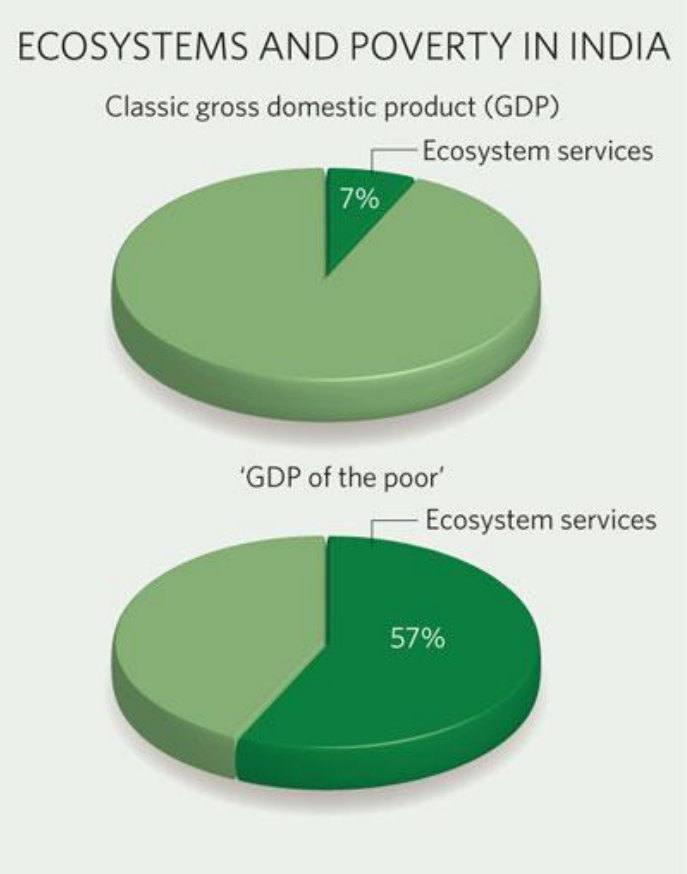


Figure 1: **Comparison between standard GDP accounting and the "GDP of the poor", with respect to ecosystem services**
(Sukhdev, 2009, based on GIST, 2003).

include the needs of the poor in national accounting, it is nonetheless true that the economic valuation of ecosystem services and natural resources in general remains highly problematic.

References

Common, M., and S. Stagl. 2005. Ecological economics: and introduction. Cambridge: Cambridge University Press.

Sukhdev, P., 2009. Costing the Earth. *Nature*, 462: 277.

44. Governance

Broad definition

Governance is what authorities do. It refers to the practical management of power and policy. Governance may be exercised by a government (nation-state), a corporation (business entity), through customary institutions (tribe, family, etc.) and so on. It may be used for any purpose, good or evil, for profit or not.

Application

Three of the main bodies that have promoted the concept of governance since the 1980s are the World Bank, the International Monetary Fund (IMF) and the United Nations Development Programme (UNDP). The World Bank defines governance as "the exercise of political authority and the use of institutional resources to manage society's problems and affairs" (WB, 1991).. According to the UNDP, governance is "the rules of the political system to solve conflicts between actors and adopt decision (legality). The term has also been used to describe the 'proper functioning of institutions and their acceptance by the public' (legitimacy), and to invoke the efficacy of government and the achievement of consensus by democratic means (participation" (UNDP, 2004).

In this context, "good governance" has become a dominant buzzword in the literature on sustainable/international development, implying that "bad governance" is one of the root causes of all evil within our societies. Major donors and international financial institutions (IFIs) such as the World Bank (WB) and International Monetary Fund (IMF) routinely base aid and loans on condition of structural adjustment reforms to ensure that measures of "good governance" are undertaken.

According to the United Nations, good governance has eight characteristics (UNESCAP, 2006):

- *Participation:* participation is a key cornerstone of good governance. Participation could be either direct or through legitimate intermediate institutions or representatives. Participation needs to be informed and organized. This means freedom of association and expression on the one hand and an organized civil society on the other hand.

- *Rule of law:* good governance requires fair legal frameworks that are enforced impartially. Impartial enforcement of laws requires an independent judiciary and an impartial and incorruptible police force.
- *Transparency:* transparency means that decisions taken and their enforcement are done in a manner that follows rules and regulations. It also means that information is freely available and directly accessible.
- *Responsiveness:* good governance requires that institutions and processes try to serve all stakeholders within a reasonable timeframe.
- *Consensus oriented:* good governance requires mediation of the different interests in society to reach a broad consensus in society on what is in the best interest of the whole community and how this can be achieved.
- *Equity and inclusiveness:* a society's well being depends on ensuring that all its members feel that they have a stake in it and do not feel excluded from the mainstream of society.
- *Effectiveness and efficiency:* good governance means that processes and institutions produce results that meet the needs of society while making the best use of resources at their disposal.
- *Accountability:* accountability is a key requirement of good governance. Not only governmental institutions but also the private sector and civil society organizations must be accountable to the public and to their institutional stakeholders.

Critique

Politics involves processes by which a group of people with initially divergent opinions and interests reach decisions, while governance conveys the administrative and process-oriented elements of governing. Such a definition assumes the possibility of separating "politics" and "administration" but this distinction is questionable, giving the facts that both notions involve aspects of power.

Amongst political ecologists the concept of governance has developed a usage distinct from that expressed in the broad definition above. It refers to the trend away from state-centric forms of social and economic regulation, and the transfer of its regulatory and administrative functions to variously scaled non-state actors (consumers, NGOs, corporations, and social movements, for example) and institutions (such as global environmental accords, corporate codes of conduct, and investment treaties) in the governance of society–environment relations (Liverman 2004 in Himley 2008). This reconfiguration of the public-private divide has occurred largely as states have ceded authority over resource questions with the implementation of neoliberal policies, (through for example the internationally networked interaction of IFI, INGOs and states at different scales) which favour public–private 'partnerships' and market-based mechanisms as means to achieve 'efficient' resource use and allocation (Liverman 2004; Mansfield 2007a; McCarthy and Prudham 2004; Robertson 2004, 2007, in Himley 2008).

In grappling with these issues, referred to as matters of *environmental governance*, political ecologists, like ecological economists, are particularly concerned with

institutions that structure resource access, use, and conservation, and with property rights regimes, especially how traditional systems of complex and overlapping property rights have been transformed through processes of imperialism, internal colonialism, state formation, and capitalist development (Jacoby 2001; Neumann 1998, 2004 in Himley 2008) to dispossess traditional resource users and erase their customary resource management institutions. In this regard, the concept of **enclosure** as a means for reconfiguring property rights is seen as key to the implementation of neoliberal reforms (Himley 2008).

Conclusion

It is no coincidence that "good governance" has emerged as a model for assessing the efficiency of economies and viability of political bodies. It is because the states that set the standards for comparison are also the powerful, liberal democratic states of Europe and North America. In 1996 the IMF declared that "promoting good governance in all its aspects, including by ensuring the rule of law, improving the efficiency and accountability of the public sector, and tackling corruption, are essential elements of a framework within which economies can prosper" (IMF, 2005). By this assertion, a prosperous economy is merely an economy able to reimburse credit. Furthermore, although it is regarded it as an essential tool for strengthening democracy (democracy, good governance and development are even said to be "inseparably linked") (Diamond 2005), promoters of good governance do not seem to acknowledge that by definition, the capitalist firm is anything but democratic, as its owner(s) are fundamentally autonomous in decision-making. In practice then, the doctrine of governance is a deeply ideological and politically powerful tool for the promotion of neoliberal reforms under global capitalism, that ultimately demands minimization of state power and legitimization of that of the market.

References

Diamond, Prof. Larry, Democracy, Development and Good Governance: The Inseparable Links. Lecture of the Ghana Center for Democratic Development (CDD-Ghana) British Council Hall, Accra, Ghana March 1, 2005 (Accessed Sept 19 2010 from http://www.cddghana.org/documents/Lecture%20by%20Larry%20Diamond.pdf)

Himley, Matthew, 2008. Geographies of Environmental Governance: The Nexus of Nature and Neoliberalism. Geography Compass 2/2 (2008): 433–451

International Monetary Fund (IMF), 2005. The IMF's approach to promoting good governance and combating corruption — a guide. Washington DC: IMF.

United Nations Development Programme (UNDP), 2004. Regional project on local governance for Latin America. New York: UNDP.

United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), 2006. What is good governance? Bangkok: UNESCAP.

World Bank (WB), 1991. Managing development: the governance dimension. Washington DC: WB.

45. Green Accounting

Definition

Green accounting is the popular term for environmental and natural resource accounting, which incorporates environmental assets and their source and sink functions into national and corporate accounts (Bartelmus, 2008).

Application

The United Nations first issued a handbook on a System for integrated Environmental and Economic Accounting (SEEA) in 1993. SEEA introduces nature's environmental and economic assets and the 'environmental cost' of their degradation and depletion into the System of National Accounts (SNA). Asset accounts (see **Figure 1** below) measure the value of opening and closing stocks of economic and environmental assets, and their changes during an accounting period. Changes in assets are brought about by the formation and consumption of produced and natural capital (assets) and other non-economic influences such as discoveries, natural disasters or natural regeneration. The latter, i.e. 'other asset changes,' are recorded outside of income and production accounts and affect the conventional indicators of cost, income, product and capital formation. National environmental accounting requires adding up inputs, outputs and environmental impacts, and combining them into environmentally adjusted ('greened') indicators. The SEEA uses both monetary values (prices, costs) and physical weights (in particular the mass of material flows) to this end (Bartelmus, 2008).

According to Bartelmus' review, case studies of green accounting have applied market valuation mostly to natural resource depletion. In the absence of market prices for non-produced natural assets, natural resource rents earned by selling resource outputs in markets are used for estimating the net present value and value changes (notably from depletion) of an asset. For environmental degradation, maintenance costs of avoiding or mitigating environmental impacts can be applied. A few studies used damage valuations of environmental impacts (Bartelmus, 2008).

However, we may ask how could we possibly give a money value to the loss of biodiversity (in the present rapid extinction) by any of these methods. We do not know what we are physically losing (which species disappear, micro-organisms for instance), much less can we give money values to such loss.

			Assets	
	OPENING STOCKS	Economic assets	Environmental assets	
	Industries	Households/Government	+	Other countries
	DOMESTIC PRODUCTION	FINAL CONSUMPTION	CAPITAL FORMATION	CAPITAL ACCUMULATION	REST OF THE WORLD
SUPPLY of products	Output				Imports
USE of products	Intermediate consumption	Final consumption	Gross capital formation		Exports
CAPITAL use	Capital consumption		Capital consumption		
NATURAL ASSET use	Environmental cost	Environmental cost	Natural capital consumption		
			+		
			Other asset changes	Other asset changes	
			=		
		CLOSING STOCKS	Economic assets	Environmental assets	

Figure 1: SEEA flow and stock accounts.
(Source: Bartelmus, 2008)

Strengths and weaknesses

Bartelmus sees a particular strength of green accounting as the measurement of environmental costs caused by economic agents of households and enterprises. According to him: “The well-known polluter/user pays principles hold the responsible agents accountable for their environmental impacts” and “it can assess the economic and ecological efficiency of different environmental protection measures by governmental and non-governmental organizations” (Bartelmus, 2008).

Critics however argue that the use of market values amounts to ‘pricing the priceless’ categories of nature. In their view, assessing environmental assets and their services in monetary terms ‘commodifies’ nature, or turns the products and services of nature into merchandise or commodities with money prices, whose intrinsic value should not be subjected to market *preferences* (Bartelmus, 2008).

References

Bartelmus, Peter (Lead Author); Amy Richmond and Surender Kumar (Topic Editors). 2008. "Green accounting." In: Encyclopedia of Earth. Eds. Cutler J. Cleveland and the Environment) [Online]

URL:http://www.eoearth.org/article/Green_accounting[First published in the Encyclopedia of Earth August 9, 2006; Last revised September 17, 2008; Retrieved October 20, 2009]. Environmental Information Coalition, National Council for Science,Washington, D.C.

United Nations (1993): Integrated Environmental and Economic Accounting. United Nations, New York (sales no. E.93.XVII.12)

46. Greenwash

Definition

The term "*Greenwash*" was coined by environmental activists to denounce misleading advertising campaigns made by industrial corporations to depict themselves more environmentally-friendly and ecologically-conscious than they actually were. There is no consensus over an appropriate definition of Greenwash, however a simple and clear one is: *"disinformation disseminated by an organization so as to present an environmentally responsible public image"*. The origin of this name derives from 'whitewash', defined by the Cambridge Advanced Learner's Dictionary as *"an attempt to stop people from finding out the true facts about a situation"*. Similarities with the term 'brainwash' (*"make someone believe something by repeatedly telling him that it is true and preventing any other information from reaching him"*) can also be underscored.

Identifying Greenwash

Greenpeace, one of the world's leading environmental NGOs, identifies 4 different types of corporate Greenwashing. The first (Dirty Business) highlights cases in which companies advertise a green product, while their primary activities are heavily polluting. One example is found in the automotive industry whereby companies advertise the production of ecological cars (manufacturing only a few thousand units per year) while continuing to produce several thousand heavily polluting cars per month. A second category (Ad Bluster) is used to *"exaggerate an environmental achievement to divert attention away from environmental problems"*. This is the case when a company spends more for advertising campaigns than actually coping with environmental pollution. Third (Political Spin) is the paradox of a company promoting a 'green' profile, while investing massively in anti-environmental lobbying activities. Last (It's the law, stupid!), companies use advertising campaigns underlining major environmental achievements while these behaviors had already been required or mandated by existing laws.

Consequences of and reactions to Greenwash

Greenwashing is bad practice for several reasons. It is harmful for the environment, because it tends to minimize the real environmental effects of products or industries advertised as 'green'. It is negative for consumer protection, since consumers are victims of misleading information and therefore are more likely to lose confidence in

green products in general. It is detrimental to companies themselves, because their reputation regarding public perception might worsen, resulting in exactly the opposite of what the commercial was meant to achieve. Regulation of this practice exists in Europe, under the Unfair Commercial Practice Directive 2005/29/EC which implies more state control, but its implementation at the national level still varies between those member states that focus primarily on unfair competition and those putting consumer protection first. To counter proliferation of Greenwashing, some environmental NGOs have launched annual 'Greenwash awards', in order to raise awareness in the media and to draw public attention to corporate social responsibility (CSR) strategies that merely give the *impression* that the necessary steps for managing pollution are being taken.

Figure 1: Image taken from www.climategreenwash.org

New tendencies

The risk of being accused of Greenwashing by NGOs has driven companies to adopt new strategies. It is often alleged that multi-national corporations finance the watering-down of serious political commitments to greenhouse gases reductions and obligations, and try to undermine scientific evidence about man-induced climate change through the sponsoring of "independent think-tanks". Another interesting tendency is what has been termed "government greenwash". In the context of growing public awareness of climate change issues, this term refers to governments' efforts to promote 'green' rhetoric in order to gain public support, while continuing support of heavily polluting industries or sponsorship of projects with well-known environmentally devastating consequences.

References:

CorpWatch.org, *Greenwash Fact Sheet, Defining Greenwash*, March 22nd, 2001: http://www.corpwatch.org/article.php?id=242

Friends of the Earth, *Greenwash confronted: misleading advertising regulation in the EU and its member states*, Report, September 2007, www.foeeurope.org

Ramus C. and Muntiel I. (2005), *When Are Corporate Environmental Policies a Form of Greenwashing?*; *Business Society*, Vol. 44 No. 4; p. 377-414.

Hoedeman O., *ExxonMobil funds climate skeptics: will Brussels clear the air?*; in http://www.spinwatch.org/, 13 March 2007.

Websites:

http://www.businessethics.ca/greenwashing/

http://www.corpwatch.org/article.php?id=242

http://stopgreenwash.org/criteria

47. HANPP and Colonization

Background and definition

Colonization of natural processes has been defined as ‘‘the intended and sustained transformation of natural processes by means of organized social interventions for the purpose of improving their utility for society’’ (Weisz et al. 2001:124). For example, agriculture transforms natural terrestrial ecosystems into agro-ecosystems. The relevance of colonization for sustainability does not lie in the amount of matter or energy expended, but in the effectiveness in changing the dynamics of a natural process in a socially desired way. The efficiency of colonization depends on how well one understands the processes at hand and how effectively one is able to control and manipulate them. The notion can be applied to several biological processes (e.g. domestication of animals, genetic engineering, etc. including land use—that is, the colonization of terrestrial ecosystems). Colonization does not imply that society controls all aspects of a natural system. Normally only a few key variables are actively controlled or influenced, and the dynamics of the systems are still, to a large extent, determined by self-organization. For example, on cropland agriculture it controls species composition, soil fertility, and nutrient (and sometimes water) availability, but it does not change the climate nor the principal photosynthetic reaction in plants (Haberl et al. 2004).

Humanity’s impact on the biosphere’s structures (e.g., land cover) and functioning (e.g., biogeochemical cycles) is considerable, exceeding natural variability in many cases (Crutzen and Steffen 2003). Up to 83% of the global terrestrial biosphere has been classified as being under direct human influence, based on geographic proxies such as human population density, settlements, roads, agriculture and the like (Sanderson et al. 2002); Hannah et al. (1994) estimate that about 36% of the Earth’s bioproductive surface is “entirely dominated by man”. *HANPP, the “human appropriation of net primary production,”* is an aggregated indicator that reflects both the amount of area used by humans and the intensity of land use (Haberl et al. 2007b).

Why HANPP?

Humans depend on land and the resources it provides for their subsistence. Plant biomass is one of the most important of these resources. Humans depend on it for: food directly and as feed for livestock, other energy (e.g. firewood, agro-fuels), paper pulp and construction material as well as other **ecosystem services** such as retaining water, maintaining soil and storing carbon. In addition humans also depend on land for infrastructure and living space and for all these purposes alter natural land cover, reducing its vegetative productivity, as well as destroying and extracting biomass, hence reducing the energy available for other species. Biomass- based subsistence economies, are those in which communities depend almost entirely on local biomass for their survival. One CEECEC case study from India, in Mendha Lekha, Maharashtra, studies such a society.

Plants through photosynthesis convert and store energy from the sun, part of which they use for their own functioning and growth. The leftover energy, called net primary production (NPP) does not only provide energy for human existence but also plays an important role for the survival of other organisms and ecosystem functioning , as it constitutes the basis of most food chains.

HANPP measures to what extent land conversion and biomass harvest alter the availability of trophic (biomass) energy in ecosystems. It is a prominent measure of the "scale" of human activities compared to natural processes (i.e. of the "physical size of the economy relative to the containing ecosystem;" Daly 2006:1). As human harvest of biomass is a major component of HANPP, it is also closely related to socio-economic metabolism (Ayres and Simonis 1994, Fischer-Kowalski and Haberl 1997) as measured by material flow accounts (MFA). The basic question of how much of the biosphere's yearly biomass flows is used by humans was first posed in the 1970s by Whittaker and Likens (1973), and it took more than a decade until the first comprehensive – and still relevant – answer to that question was given by Vitousek et al. (1986) (Haberl et al. 2007b).

Approaches to HANPP

Like other scientific concepts, different approaches may lead to substantially different empirical results. Various authors have approached HANPP from different angles and have consequently used a variety of definitions (see Vitousek et al. (1986), Wright (1990), Rojstaczer et al. (2001) and Imhoff et al. (2004).

Haberl (1997) proposed a definition of HANPP that has proven its usefulness in spatially explicit (Haberl et al. 2001) as well as long-term (e.g. Krausmann 2001) studies on a national scale. This definition defines HANPP as the difference between the amount of NPP that would be available in an ecosystem in the absence of human activities (NPP_0) and the amount of NPP which actually remains in the ecosystem, or in the ecosystem that replaced it under current management practices (NPP_t). NPP_t can be calculated by quantifying the NPP of the actual vegetation (NPP_{act}) and subtracting the amount of NPP harvested by humans (NPP_h) (Haber et

al 2007b). NPP_h includes primary crop harvest but also harvest losses i.e. residues or biomass destroyed during harvest, grazing and human induced fires. Based on the above HANPP is therefore defined according to the formula:

$HANPP = NPP_0 - NPP_t$ with $NPP_t = NPP_{act} – NPP_h$.

The difference between NPP_0 and NPP_{act} represents the reduction of NPP_0 through the conversion of natural land cover to other types of land cover i.e the land use induced productivity changes which one denotes as ΔNPP_{LC} (Haberl et al. 2007a) HANPP is therefore also equal to $NPP_h+\Delta NPPL_C$.

In order to calculate HANPP according to the above formulas and **Figure 1** requires information on the development of land use, productivity of vegetation, biomass harvest and related harvest factors. This is provided through agricultural and land use statistics, yearly productivity values and agricultural literature.

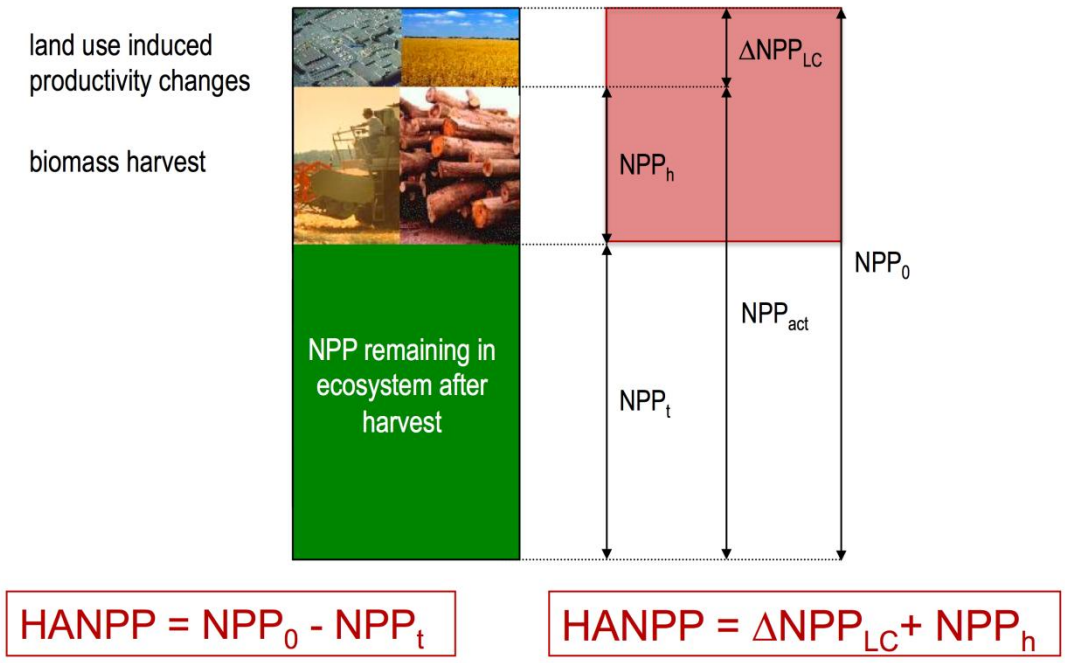


Figure 1 : Calculating HANPP

Implications of HANPP

An obvious implication of HANPP is that growth in the amount of biomass used by humans for their socio-economic metabolism must be envisaged with caution. Biomass already plays a significant role in global socio-economic energy supply, currently contributing some 9-13%, that is 35-55 EJ/yr (1 EJ = 10^{18} Joule), to the global supply of technical energy (fuelwood, agrofuels). This figure, however, by far

underestimates the importance of biomass for humanity's "energetic metabolism": Global human biomass harvest, including crops, by-products, grazing by livestock, fibre consumption and forest products amounted to about 235 EJ/yr around 1993. Notable future increases in biomass demand are expected. The projected growth of world population (until "peak population" is reached in abut 2050) together with likely changes in human diets towards meat consumption, are strong driving forces for further increases in the amount of biomass required as food and feed. Moreover, many energy scenarios also envisage increases in the amount of biomass used for energy provision.

HANPP alters energy flows within food webs and based on the species-energy hypothesis, has been hypothesized to contribute to biodiversity loss (Wright 1990). HANPP is relevant in the context of global water flows (Gerten et al., 2005), carbon flows (e.g. DeFries et al. 1999) and – as biomass contains nitrogen (N), and N fertilizer is an important factor for agricultural productivity – N flows.

It also relates to important global sustainability issues such as endemic malnourishment of a large proportion of world population (FAO, 2005), the ongoing conversion of valuable ecosystems (e.g., forests) to infrastructure, cropland or grazing land (see e.g. Millenium Ecosystem Assessment, 2005) with detrimental consequences for biodiversity (Heywood and Watson, 1995), and global, human-induced alterations of biogeochemical cycles (e.g. Steffen et al., 2004) (Haberl et al 2007b).

In addition to looking at HANPP in relation to a certain territory, it is also useful to investigate the HANPP embodied in certain biomass-based products (see Haberl et al. 2009). Products derived from using land and appropriating biomass are seldom consumed locally or domestically but are often produced for export. Therefore some countries or communities might have a high HANPP on their territory but this might not actually reflect their consumption of HANPP. Or put differently, the environmental impacts on a particular territory might not stem from local consumption. Embodied HANPP reflects this disconnect between areas of production (and therefore appropriation of biomass) and NPP and consumption of final products. So on top of showing how certain products draw on ecosystems, it can also be used as a socio-political indicator of resource distribution and unequal exchange. In this context, the related questions of who appropriates NPP flows most and at what cost, of who controls them and in which form, and of who controls land in terms of biomass production (quantity), are highly relevant.

References

Ayres, R. U. and Simonis, U. E. (1994): Industrial Metabolism: Restructuring for Sustainable Development. Tokyo, New York, Paris, United Nations University Press.

Crutzen, P. J. and Steffen, W., (2003): How long have we been in the anthropocene era? Climatic Change 61(3), 251-257.

Daly, Hermann, E. (2006): The Concept of Scale in Ecological Economics: Its Relation to Allocation and Distribution. Internet Encyclopedia of Ecological Economics [online] URL: http://www.ecoeco.org/publica/encyc.htm, International Society for Ecological Economics (ISEE).

DeFries, R. S., Field, C. B., Fung, I., Collatz, G. J., Bounoua, L. (1999). Combining satellite data and biogeochemical models to estimate global effects of human-induced land cover change on carbon emissions and primary productivity. Global Biogeochemical Cycles 13(3), 803-815.

Fischer-Kowalski, M. and Haberl, H. (1997): Tons, Joules and Money: Modes of Production and their Sustainability Problems. Society and Natural Resources 10(1), 61-85.

Gerten, D., Hoff, H., Bondeau, A., Lucht, W., Smith, P., Zaehle, S. (2005): Contemporary "green" water flows: Simulations with a dynamic global vegetation and water balance model. Physics and Chemistry of the Earth, Parts A/B/C 30(6-7), 334-338.

Haberl, H., Erb, K-H., Krausmann F., Berecz, S., Ludwiczek, N., Martínez-Alier, J., Musel, A., Schaffartzik, A. (2009): Using embodied HANPP to analyze teleconnections in the global land system: Conceptual considerations. Danish Journal of Geography 109(1), pp.1-6, in press.

Haberl, H., Erb, K.H., Krausmann, F., Gaube, V., Bondeau, A., Plutzar, C., Gingrich, S., Lucht, W. and Fischer-Kowalski, M. (2007a): Quantifying and mapping the human appropriation of net primary production in earth's terrestrial ecosystems. Proceedings of the National Academy of Sciences, 104:12942-12947.

Haberl, H., Erb, K.H, Krausmann, F. (2007b): Human appropriation of net primary production (HANPP). Internet Encyclopedia of Ecological Economics [online] URL:http://www.ecoeco.org/publica/encyc.htm, International Society for Ecological Economics (ISEE)

Haberl, H., M. Fischer-Kowalski, F. Krausmann, H. Weisz, V. Winiwarter (2004): Progress towards sustainability? What the conceptual framework of material and energy flow accounting (MEFA) can offer. Land Use Policy 21(3), 199-213.

Hall, C.A.S., Cleveland, C.J., Kaufmann, R.K. (Eds.) 1986. Energy and Resource Quality, The Ecology of the Economic Process. Wiley-Interscience, New York.

Hannah, L., Lohse, D., Hutchinson, C., Carr, J. L., Lankerani, A. (1994): A Priliminary Inventory of Human Disturbance of World Ecosystems. Ambio 23(4-5), 246-250.

Heywood, V. H. and Watson, R. T. (1995). Global Biodiversity Assessment. Cambridge, Cambridge University Press, United Nations Environment Programme (UNEP).

Imhoff, M. L., Bounoua, L., Ricketts, T., Loucks, C., Harriss, R., Lawrence, W. T. (2004): Global patterns in human consumption of net primary production. Nature 429, pp. 870-873.

Krausmann, F. (2001): Land Use and Industrial Modernization: an empirical analysis of human influence on the functioning of ecosystems in Austria 1830 - 1995. Land Use Policy 18(1), 17-26.

Millenium Ecosystem Assessment (2005). Ecosystems and Human Well-Being, Synthesis. Washington, D.C., Island Press.

Müller-Herold, U., Sieferle, R.P. (1998). Surplus and survival: risk, ruin, and luxury in the evolution of early forms of subsistence. Advances in Human Ecology 6, pp. 201–220.

Rojstaczer, S., Sterling, S. M., Moore, N. (2001): Human Appropriation of Photosynthesis Products. Science 294(5551), pp. 2549-2552.

Sanderson, E., Jaiteh, M., Levy, M., Redford, K., Wannebo, A., Woolmer, G. (2002): The human footprint and the last of the wild. BioScience 52(10), pp. 891-904.

Steffen, W., Sanderson, A., Tyson, P. D., Jäger, J., Matson, P. A., Moore III, B., Oldfield, F., Richardson, K., Schellnhuber, H. J., Turner II, B. L., Wasson, R. J.(2004): Global Change and the Earth System. A Planet Under Pressure. Berlin, Springer.

Vitousek, P. M., Ehrlich, P. R., Ehrlich, A. H., Matson, P. A. (1986): Human Appropriation of the Products of Photo- synthesis. BioScience 36(6), pp. 363-373.

Weisz, H., Fischer-Kowalski, M., Grünbühel, C.M., Haberl, H., Krausmann, F., Winiwarter, V. (2001): Global environmental change and historical transitions. Innovation 14 (2), 117–142, pp. 124.

Whittaker, R. H. and Likens, G. E., 1973. Primary Production: The Biosphere and Man. Human Ecology 1(4), pp. 357- 369.

Wright, D. H. (1990): Human impacts on the energy flow through natural ecosystems, and implications for species endangerment. Ambio 19(4), pp. 189-194.

48. Hazards, Disasters, and Complex Disasters

Definition

The term ‘disaster’ has its roots in Latin, *dis* – and - *astro*, meaning ‘away from the stars’. In other words, a disaster was seen as an event arising from an unfortunate astrological configuration. The UN defines an international disaster as “a serious disruption of the functioning of society, causing widespread human, material and or

environmental losses which exceed the capacity of the affected society to cope using only its own resources" (UN, 1992). Thus, not all adverse events may be classified as a disaster: only those that affect humans, and overwhelm response capacity. Disasters may be natural (earthquakes, hurricanes, tsunamis, floods, famines, fire, etc.) or man-made (arising out of war and technological failures). The same natural causes (say, an earthquake of similar magnitude) may have very different impacts on human society, through what is called "the social amplification of risk".

Characteristics and Causes

Scholars have identified some recent trends in the occurrences, impacts and causes of natural disasters. First, the world is facing disasters on an unprecedented scale with about 400 disasters reported each year. The OFDA/CRED International Disaster Database (EM-DAT) reports a 20-fold increase in the occurrence of natural disasters since the 1950s affecting 250 million people annually. In the last decade (1998-2007), natural disasters claimed an average of 70,000 lives per year and an annual economic loss of US$ 77 million (EM-DAT). These figures must be read with caution since much of this rise can be attributed to the increase in the variety of sources used (e.g. insurance companies, WHO, World Food Programme) as well as more people reporting disasters, however small they may be, due to improved communication technology and want of humanitarian aid. However, in the last 30 years, with acute monitoring and improved reporting mechanisms there still has been a four times increase in the number of recorded disasters (Guha-Sapir et al. 2004).

In general, two causes are attributed to the increased frequency of natural disasters. The first is climate change (natural and anthropogenic) and environmental degradation resulting in the loss of buffer zones (such as mangroves, dunes, wetlands), destabilization of slopes, etc.. The second reason for increased natural disasters relates to the patterns of increased human settlements in vulnerable areas, particularly growing urban conglomerates making millions of people susceptible at once (Guha-Sapir 2004, Coppola 2006).

While disasters make no distinction between rich and poor countries in their occurrence, the human impact of disasters on poor countries have been disproportionately high owing to their proportionately large surface area and population, together with a lack of effective disaster mitigation and management structures (Guha-Sapir 2004, Coppola 2006). On an average it is reported that 65% of disaster related deaths and injuries are sustained in countries with per-capita income lower than $760 annually, although these countries account for only 11% of the world's "at-risk" population (UNDP, 2004). Thus, inferences have been drawn that links a nations' vulnerability to disasters with that of their human development index (Noji 1997, Guha-Sapir 2004, Coppola 2006).

Economic Impacts

Economic losses from disasters have increased 15 times since the 1950s (EM-DAT). However, most of the economic damage occurs in high income countries as

compared to poorer nations. The total economic damage between 1991 and 2005 has been about US$ 800 billion in rich countries, while in developing nations it was only half (EM-DAT). Some of the reasons for this are the fact that the poor and their possessions are cheap, the high concentration of wealth and physical structures in rich urban centres, dependency on technology and energy for economic activities that may fail during a disaster (Coppola 2006).

However, the loss in terms of percentage of GDP hits the poorer nations harder. Scholars argue that the aftermath of a disaster exacerbates the debilitating causes of poverty in developing countries (Guha-Sapir 2004, Coppola 2006). In other words, developing economiesin the wake of a disaster must reallocate a sizeable portion of their GDP to recovery that would otherwise be used for development projects and social programs elsewhere in the country. In some cases, this can prove to be ruinous to the developing economies as compared to their industrialized counterparts. For example, in 1998 hurricane Mitch incurred a loss equal to 42% of the GDP of Honduras and 50% of Nicaragua, the total loss being less than US$ 3.5 billion (EM-DAT). The 1990 cyclone in Samoa amounted to a loss of US$ 119 million, which was equal to 62% of their GDP. On the other hand, the Kobe disaster that amounted to US $ 159 billion cost only 3% of Japan's GDP (Guha-Sapir 2004).

Factors of Vulnerability

There seems to be consensus that the main cause of vulnerability to natural disasters is poverty and underdevelopment. Guha-Sapir (2004) lists four factors affecting vulnerability, all of which are linked to underdevelopment: (a) *Physical*, that is the level of exposure of a population to potential hazard, (b) *Social*, that includes variables such as population growth, inherent conflicts and insecurity, gender or age discrimination, and access to social security nets, (c) *Economic*, that translates into dependency on agriculture, economic diversification, access to loans, insurances and basic infrastructure, and (d) *Environmental*, such as soil degradation and erosion, biological and chemical pollution, and water availability. All of these are linked to underdevelopment and poverty as a direct cause, and so the common response to reducing effects of natural disasters is to encourage development in poorer nations.

The Centre for Research on the Epidemiology of Disasters (CRED) has established a voluminous online database on disasters and their trends (http://www.emdat.be/). For a disaster to be entered into the EM-DAT database, i.e. be classified as a disaster, at least one of the following criteria must be fulfilled:

- Ten (10) or more people reported killed.
- Hundred (100) or more people reported affected.
- Declaration of a state of emergency.
- Call for international assistance.

EM-DAT distinguishes the following general disaster types:

- Geophysical disasters, defined as “events originating from solid earth”, e.g. earthquakes, volcanoes - dry mass movement
- Meterological disasters, defined as “ events caused by short-lived/small to meso scale atmospheric processes (in the spectrum from minutes to days), e.g. storms
- Hydrological disasters, defined as “events caused by deviations in the normal water cycle and/or overflow of bodies of water caused by wind set-up”, e.g. floods i.e. wet mass movement
- Climatological disasters, defined as “events caused by long-lived/meso to macro scale processes (in the spectrum from intra-seasonal to multi-decadal climate variability), e.g. extreme temperature, drought, wildfire and
- Biological disasters, defined as one “caused by exposure of living organisms to germs and toxic substances” e.g. an epidemic. Also included in this group are insect infestations and animal stampedes.

Complex Disasters

The term ‘complex disasters’ was first introduced by Singh and colleagues (based on their research in the Nicobar islands in the aftermath of the tsunami of 2004) to characterise a situation where the logic of humanitarian aid comes into conflict with that of sustainability. Such a condition arises when the goals of humanitarian aid and sustainability become incompatible in terms of their system of meaning, goals, structures and approach in a post-disaster context (Singh et al. 2008, Singh 2009).

Thus, a ‘complex disaster’ refers to a state that has become more vulnerable than it was prior to the disaster itself, as a consequence of inappropriate human interventions leading to (a) a breakdown of institutional structures and thus a loss of reorganising capacity, (b) failure of the society to maintain its material and energetic metabolism with its environment, and (c) creation of dependence on higher systems for continuous resource flows for its survival.

a) **Breakdown of institutional structures (loss of stabilizing and reorganizing capacity)**: The vast literature on resilience has argued that socioecological systems in general retain varying capacities to ‘absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks’ (Walker et al. 2004). In the context of hazards and disasters, societies are able to overcome the damages brought about by the occurrence of natural hazards, either through maintaining their pre-disaster social fabric, or through accepting marginal or larger change in order to survive (Gaillard 2006). We take it that the capacity of societies to reorganise themselves and find a new stable state are embedded in their existing institutional structures that help to maintain and regulate social and power relations as well as their relationship to nature. Institutions may be referred to as conventions, norms and formally sanctioned rules of society providing expectations, stability and meaning essential to human existence (Vatn, 2006). Thus, they may vary from formal family or political structures to informal rules

and norms that govern societal behaviour. Breakdown of institutions as a consequence of inappropriate interventions may result in the loss of these inherent attributes for restoration and reorganization into a new stable state, thereby increasing the level of distress and vulnerability than what had been just after a disaster. In this sense, the loss is not in physical terms, but in the *capacities* of society to reorganise itself.

b) **Failure of the society to maintain its metabolism / changes in society-nature interactions:** The second variable central to the notion of complex disasters relates to the failure of the society to maintain its metabolism in the way it once did. This relates to the notion of 'society's metabolism**'**, where a society organizes (via their formal and informal institutions) material and energy exchanges with its natural environment necessary for the maintenance and reproduction of a society: they extract primary resources and use them for food, machines, buildings, infrastructure, heating and many other products and finally return them, with more or less delay, in the form of wastes and emissions to their environments. Any society's existence would be impossible without these biophysical exchanges with nature. The quantity and structure of matter and energy a society draws from its environment largely depends on their mode of subsistence and lifestyle, which in turn is related to technology.

c) **Increasing dependency on higher systems**: Since the last decades large parts of the agrarian 'developing world' have become increasingly integrated within a global division of labour and the world market. Under the rubric of development, nation states have devised programmes to expedite this process by introducing a variety of services (education, medical, legal), transport infrastructure, subsidies, and fossil fuel based technologies in agriculture. While they indeed improve the quality of life to some extent (access to clean water, health care, legal rights, etc.), these interventions require heavy inputs of resources from the outside to sustain them. In other words, these economies – still largely unchanged and quintessentially retaining an agrarian mode of production – are not able to generate an income to pay for the quality of life based on increased resource flows or subsidies from outside. Over time, these societies become dependent on constant supplies, subsidies and services to meet their needs, the failure of which may lead to set-backs and impoverishment. Humanitarian aid, if inappropriately organised, may guide the system into a similar system of dependency and vulnerability.

References

Coppola, D. (2006). Introduction to International Disaster Management. Elsevier.

EMDAT – The International Emergency Disasters Database. Centre for Research on the Epidemiology of Disasters. http://www.emdat.be/

Fischer-Kowalski, M., and H. Haberl (2007). *Socioecological Transitions and Global Change. Trajectories of Social Metabolism and Land Use*, Cheltenham: Edward

Elgar.

Gaillard, Jean-Christophe (2006). 'Traditional Societies in the Face of Natural Hazards: The 1991 Mt. Pinatubo Eruption and the Aetas of the Philippines', *International Journal of Mass Emergencies and Disasters*, vol. 24, no. 1, pp. 5–43.

Guha-Sapir, D., Hargitt, D., Hoyois, P. (2004). *Thirty years of natural disasters 1974-2003: The Numbers,* UCL Presses Universitaires De Louvain.

Noji, E. (1997). *The Public Health Consequences of Disasters*. Oxford University Press: New York.

Singh, S., J., Fischer-Kowalski, M. and Haas, W. (2008): Humanitarian aid and Ecological Consequences. The Nicobar Islands as a case of 'complex disaster'. Paper presented at the conference "Re-examining disaster, recovery and reconstruction: Social science perspectives on the tsunami" held in New Delhi, 14-15 January 2008

Singh, Simron J. (2009): Complex disasters: the Nicobar Islands in the grip of humanitarian aid. In: *Geographische Rundschau - International Edition* 5(3), pp. 48-56.

UNDP (1994). Human Development Report 1994. Oxford University Press: New York & Oxford.

United Nations, Department of Humanitarian Affairs (1992). *Internationally Agreed Glossary of Basic Terms Related to Disaster Management* (DNA/93/36), Geneva: United Nations.

Vatn, Arild (2006). *Institutions and the Environment,* Edward Elgar Publishing House, UK.

Walker, B., C. S. Holling, S. R. Carpenter and A. Kinzig (2004). 'Resilience, Adaptability and Transformability in Social–Ecological Systems', *Ecology and Society*, vol. 9, no. 2, p. 5: http://www.ecologyandsociety.org/vol9/iss2/art5/

49. Institutions

Institutions and agents

Contrary to standard economic theory emphasizing the role of individuals – including its "new" institutional economics variant –, ecological economists, through authors such as Daniel Bromley (2006) or Arild Vatn (2005), have highlighted the prominent role of institutions in shaping behaviours, interests and values. In so doing, they have explicitly espoused the legacy of the classical (or "old") school of institutionalism originating from Thorstein Veblen, as well as, arguably, from Karl Marx. This heterodox economic tradition understands the economy as one of *existing*

constructs, with all of its history and variety (as opposed to a deducted structure based on a set of axioms) determining how people/societies organize themselves to secure their sustenance. It emphasizes interdependencies and coordination phenomena.

Institutions are sometimes understood as organizations (such as the Catholic Church, the United Nations, etc.). This understanding is often found in the political sciences and is quite similar to everyday usage of the term. However, classical institutionalists (and, for that matter, ecological economists) tend to carefully distinguish between institutions and organisations. For them, organizations are agents, and institutions *constitute* both organizations and individuals.

Two views on institutions

Institutions are also understood as synonymous with "rules". Again, the "new" and the "old" schools of institutional economics have different perspectives on this issue:

- For Douglas North (1990), one of the leading "new" institutionalists, institutions are the rules of the game in a society or, more formally, are the humanly devised constraints that shape human interaction. The "new" school sees institutions as external constraints while individuals continue to be seen as autonomous. Behaviour will be somehow maximize utility or satisfaction attained within these constraints and it will be, in relation to others, instrumental and/or strategic (hence the use by the "new" institutionalism of competitive market and game theory models).

- In contrast, the classic (or "old") institutionalists regard institutions as *forming* individual behaviour. They simplify and offer meaning to situations. For Thorstein Veblen (1919), institutions are "settled habits of thought common to the generality of man". In the same vein, Scott (1995) argues that "institutions consist of cognitive, normative, and regulative structures and activities that provide stability and meaning to social behaviour. Institutions are transported by various carriers – cultures, structures, and routines – and they operate at multiple levels of jurisdiction".

These two definitions are very different. They represent each side of the divide between methodological individualist and social constructivist ontologies. In sum, a definition by an ecological economist (Vatn, 2005) that combines the most important aspects emphasized by classical institutionalists is the following: Institutions are the conventions, norms and formally sanctioned rules of a society. They provide expectations, stability and meaning essential to human existence and coordination. Institutions regularize life, support values and protect and produce interests.

References

Bromley, D.W., 2006. *Sufficient reason: volitional pragmatism and the meaning of economic institutions*. Princeton: Princeton University Press.

North, D.C., 1990. *Institutions, institutional change and economic performance*. Cambridge: Cambridge University Press.

Scott, R.W., 1995. *Institutions and organizations*. Thousand Oaks: Sage.

Vatn, A., 2005. *Institutions and the environment*. Cheltenham: Edward Elgar.

Veblen, T., 1919. *The place of science in modern civilization*. New Brunswick: Transactions Publishers.

50. Languages of Valuation

Environmental Conflicts: Clashes of Valuation Languages

Environmental conflicts are fought in different 'languages', that is, within different reference frames. Conflicts therefore might arise out of clashes of different interests or because of the existence of different value systems (see e.g. landscape values below). In the case of mangroves for instance, some people want to preserve them against the shrimp industry because they appreciate their ecological and aesthetic values. Other people want to preserve them because they make their livelihood and survive from them, and/or because they understand their practical role in coastal defence and as fish breeding grounds. Other people (or the same people, in other contexts) might appeal to the sense of culture and place mangroves provide for their traditional inhabitants. They might even argue that there are sacred mangroves. In all cases, environmental conflicts are expressed as conflicts of valuation, either within the parameters of one single standard of valuation, or across plural values. Thus, in a gold mining conflict, the company will probably argue in terms of the money to be gained (and shared locally for employment, taxes and royalties), while the opposition may argue for instance in terms of the uncertain risks to health from cyanide used in open cast mining, and/or in terms of the infringement of indigenous rights to the territory under Convention 169 of ILO.

To see value solely in terms of biomass, energy, culture, livelihood, or to maintain an a priori refusal of techniques of economic valuation in actual or fictitious markets, indicates a failure to grasp the existence of value pluralism, hence of different languages of valuation. It is possible to believe that, "shrimp and gold exports are valuable items of world trade", while also recognising that, "valuable ecosystems and valuable local cultures are destroyed by shrimp farming and gold mining". Which then is the true value of one pound of farm-raised shrimp or the true value of a gram of gold? The reduction of all goods and services to actual or fictitious commodities, as in cost benefit analysis, can be recognized as one perspective among several, legitimate as a point of view and as a reflection of real power structures. But who then has the power to simplify complexity, ruling some viewpoints as out of order?

50.1 Landscape Value

Landscape value corresponds to an attachment or emotional bond that people develop with places. There are strong cultural ties to landscapes and feelings for the visual beauty of mountains, lakes, coasts, forests, etc., which are a common bond among people or social groups of a given region. Arguments related to landscape values are commonly heard in Europe from opponents to the construction of wind farms for example. Landscape values may also be important for the tourism industry and landscapes can therefore be managed as a key component of tourism infrastructure.

Landscape value often has an association with environmental and natural resource values. The values that people appreciate in a landscape may often also be important ecologically. Landscape values can be divided into use value, that is, places that provide tangible benefits (such as economic value through, for instance, tourism, or recreation value) and non-use value, namely places that have spiritual, identity or ecological values.

Application

The agents of environmental conflicts are not so well identified as the agents of Ricardian or Marxian economic conflicts – landlords and capitalist farmers, in one case, capitalists and proletarians, in the second case. It might be that a fight against effluents is led by a group of conservationists, or by a group of local women concerned by children's health, or by a group of indigenous people demanding compensation, *i.e.* demanding in the language of economists the "internalization of externalities", or appealing to non-chrematistic values (such as human livelihood or the sacredness of the land).

The management and resolution of local or global ecological distribution conflicts requires cooperation between many different actors such as businesses, international organizations, NGO networks, local groups, and governments. Whether this cooperation can be based on common values and on common languages is questionable. Whenever there are unresolved ecological conflicts, there is likely to be not only a discrepancy but incommensurability in valuation (Faucheux and O'Connor 1998; Funtowicz and Ravetz 1994; Martinez-Alier, Munda and O'Neill 1998; Martinez-Alier and O'Connor 1996).

The claims to environmental resources and services of others, who are differentially empowered and endowed, can be contested by arguing inside a single standard of value or across plural values. As pointed out by O'Connor and Spash (1999), conflicts about access to natural resources or about exposure to environmental burdens and risks may be expressed:

- *in one single standard of valuation* (usually monetary). How should the externalities (*i.e.* cost-shifting) caused by a firm be valued in money terms when

asking for compensation in a court case? An appeal to economists versed in cost benefit analysis and contingent valuation would be appropriate here.

-

- *through a value standard contest* or dispute, that is, a clash in the standards of value to be applied, as when loss of biodiversity, or in cultural patrimony, or damage to human livelihoods, or infringement on human rights or loss of esthetic or sacred values are compared in non-commensurable terms to economic gains from a new dam or a shrimp farm or a mining project or from oil extraction. There is a clash in standards of valuation when the languages of environmental justice, or indigenous territorial rights, or environmental security, or sacredness, are deployed against monetary valuation of environmental burdens. Non-compensatory multi-criteria decision aids or participatory methods of conflict analysis are appropriate for this type of situation.

Any social group can simultaneously use different standards of value in support of its economic and environmental security. This is particularly true of subordinate social groups. Moreover, in complex situations marked by uncertainties and synergies, the disciplinary approach of experts is not appropriate. So, incommensurability of values arises not only because of different interests but also because of complexity that entails a plurality of legitimate perspectives and values. This point is made vivid by one question, “What is the price of oil?” asked by Human Rights Watch in 1999 in a report on the Niger Delta.

References

Faucheux, S. and O’Connor, M. (eds.), 1998. *Valuation for sustainable development: methods and policy indicators*. Cheltenham: Edward Elgar.

Funtowicz, S. and Ravetz, J., 1994. The worth of a songbird: ecological economics as a postnomal science. *Ecological Economics*, 10.

Martinez-Alier, J., 2002. *The environmentalism of the poor: a study of ecological conflicts and valuation*. Cheltenham: Edward Elgar.

Martinez-Alier, J. and O’Connor, M., 1999. Distributional issues: an overview. In: J. van der bergh (ed.), *Handbook of environmental and resource economics*. Cheltenham: Edward Elgar.

Martinez-Alier, J., Munda, G. and O’Neill, J., 1998. Weak comparability of values as a foundation for ecological economics. *Ecological Economics*, 26.

O’Connor, M. and Spash, C. (eds.), 1999. *Valuation and the environment: theory, methods and practice*. Cheltenham: Edward Elgar.

51. Lawrence Summers' Principle

Origins of the Principle

Lawrence Summers is a US economist, former President of Harvard University, former Chief Economist of the World Bank, and presently working in the Obama administration. The "Lawrence Summers' Principle" – a term coined by Martinez-Alier (1994) – can be summarized by the formula "the poor sell cheap". This "principle" originates from a 1991 memo written by Summers while he was the World Bank's chief economist. In this memo, he promotes dumping toxic waste in the Third World for economic reasons:

> "*Just between you and me, shouldn't the World Bank be encouraging more migration of the dirty industries to the LDCs [Least Developed Countries]? […] A given amount of health impairing pollution should be done in the country with the lowest cost, which will be the country with the lowest wages. I think the economic logic behind dumping a load of toxic waste in the lowest wage country is impeccable and we should face up to that."*

The Economist (February 8, 1992), to which the memo was leaked, found the language "crass, even for an internal memo", but "on the economics his points are hard to answer". As Harvard economist Stephen Marglin said, "people who have not been exposed to a college course in [standard] economics are likely to be outraged by the memo […]. After a freshman course in economics, college students begin to think like economists – that is the point of freshman economics after all – and will explain why and how both the low-wage and the high-wage countries benefit from the relocation of toxic wastes". Indeed, from Summers' viewpoint, such relocation is a win-win solution promoting economic growth in both countries and regions.

In taking this view however, Summers takes for granted (1) that any kind of growth benefits the poor; (2) that LDCs will have to follow the same development path as rich countries, namely through a polluting capitalist industrialization; (3) that prices fairly reflect environmental and social costs in both countries/regions and across social groups; (4) that both countries/regions are equally free to enter into such an exchange (and, by the same token, that governments accurately represent their populations!); and (5) that uncertainties are negligible, for instance with respect to long-term health or environmental costs.

The Principle in Action

The Philippine Associated Smelting and Refining Corporation (PASAR) provides an example of such assumptions at work (Korten, 1992). PASAR is a Japan-financed and built copper smelting plant located near the town of Isabel (Leyte Province). It produced copper cathodes and ships them to Japan for processing. The 15,000 residents of Isabel, a poor rural farming and fishing community, were promised

development, including jobs in the smelting plant and cheap electricity from the related geothermal power project. However, the jobs turned out to be mainly part-time or contractual to do their dangerous and dirty nature. The geothermal plant did provide cheap electricity for the smelter, but the rates to local residents increased. Gas and waste water emissions from the new facilities containing high concentrations of boron, arsenic, heavy metals, and sulfur compounds contaminated rivers and the local bay, reducing rice yields, damaging the forests, threatening the local water supply, reducing fishing yields, and increasing incidences of upper respiratory disease. Although the local economy has grown, Isabel's poor – the project's professed beneficiaries – have been impoverished and started to protest against the company.

Many marginalized populations offer attractive locations for those who advocate the relocation of toxic waste facilities or polluting industries as a means to give employment and increase growth. One conspicous example is the export of ships for dismantling in Alang, on the coast of Gujarat in India. The health risks from asbestos and heavy metals are born at a low economic cost by poor labourers working on the beaches. In such cases, there is no real defence against pollution dangers through market negotiation over potential damages to property rights. The market and pseudo-market valuation of damages indicate that it is much cheaper to locate such industries in poor areas than where the rich live. As Martinez-Alier (2007) pointed out, "poor people are well advised to defend their interests in languages different from that of compensation for externalities, because in the economic sphere 'Lawrence Summers' principle' ('the poor sell cheap') is operative". The Environmental Justice movement in the United States that struggles against what it calls "environmental racism", also likes to quote from Lawrence Summers´memo of 1991.

References

Korten, D.C. 1992. To improve human welfare, poison the poor: The logic of a free market economist. *People-Centered Development Forum*, Column No. 29.

Martinez-Alier, J. 1994. Distributional conflicts and international environmental policy on carbon dioxide emissions and agricultural biodiversity. In: J.C. van den Bergh and J. van der Straaten (eds.), *Toward sustainable development: concepts, methods, and policy*. Covelo, CA: Island Press.

Martinez-Alier, J. 2007. Marxism, social metabolism, and ecologically unequal exchange. In: A. Hornborg, J.R. McNeill and J. Martínez-Alier (eds.), *Rethinking environmental history: world-system history and global environmental change*. Lanham: AltaMira Press.

Marglin, S.A. 2008. *The dismal science: how thinking like an economist undermines community*. Cambridge, MA: Harvard University Press.

52. Natural (Environmental) and Social Capital

Definition

Capital is traditionally defined as produced (manufactured) means of production. A more functional definition of capital is a fund or a stock (a fishery or forest, an oil well, or a set of machines in a factory) that yields a (sustainable or unsustainable) flow of valuable goods or services into the future. What is functionally important is the relation of a fund or a stock yielding a flow – whether the fund or stock is manufactured or natural is in this view a distinction between kinds of capital and and not a defining characteristic of capital itself (Costanza and Daly, 1992:38).

Types of capital

Based on the above definition Costanza and Daly distinguish three broad types of capital: *natural, human* and *manufactured*, "which correspond roughly to the traditional economic factors of land, labour and capital" (Costanza and Daly, 1992:38).

Natural capital are the natural ecosystems that yield a flow of valuable ecosystem goods or services into the future (Costanza, 2008) For example, a population of trees or fish provides a flow or annual yield of new trees or fish, a flow that can be sustainable year after year. The sustainable flow is "*natural income*"; it is the yield from "*natural capital*". Natural capital may also provide services such as recycling waste materials, or water catchment and erosion control, which are also counted as natural income. Since the flow of services from ecosystems requires that they function as whole systems, the structure and diversity of the system is an important component in natural capital (Costanza and Daly, 1992:38).

Costanza and Daly point out the distinction between natural capital and income and natural resources and find the following definition most appropriate "natural capital and natural income are aggregates of natural resources in their separate stock and flow dimensions, and forming these aggregates requires some relative valuation of the different types of natural resource stocks and flows." So "capital and income have distinct evaluative connotations relative to the more physical connotations of the term 'resources'" (Costanza and Daly, 1992:38).

They differentiate two broad types of natural capital: (1) renewable or active natural capital, and (2) non-renewable or inactive natural capital ("Funds" and "Stocks" in Georgescu-Roegen's terminology). Renewable natural capital is active and self-maintaining using solar energy (e.g. ecosystems). Ecosystems can be harvested to yield ecosystem goods (e.g. wood) but they also yield a flow of ecosystem services when left in place (e.g. erosion control, carbon capture, recreation). Non-renewable natural capital is more passive (e.g. fossil fuel and mineral deposits) and yields no service until extracted (Costanza and Daly, 1992).

In addition to natural capital there is *human-made capital*. Here they distinguish between (1) *manufactured capital* such as factories, buildings, tools and other physical artefacts, and (2) *human capital* i.e. the stock of education, skills, culture, and knowledge stored in human beings. Agricultural seeds have been selected by humans for thousands of years, they require human knowledge to be used.

Manufactured, human and *renewable natural capital* decay at substantial rates and must be maintained and replenished continuously. The stock of *non-renewable natural capital* also decays but at a very slow pace so this can be ignored, however once it is extracted and used it is gone. *Renewable natural capital* produces both ecosystem goods and services, and renews itself using its own capital stock and solar energy. Excessive harvest of ecosystem goods can reduce renewable natural capital's ability to produce services and to maintain itself. *Manufactured capital, renewable natural capital* and *non-renewable natural capital* interact with human capital and economic demand to determine the level of marketed goods and service production. (Costanza and Daly, 1992).

Much of the discussion on Sustainability in ecological economics revolves around the issue of the limits to substitution between the different forms of capital. For instance, can manufactured capital be substituted for natural capital (can a larger fleet of fishing boats substitute for scarcity of tuna fish)?

Goodwin differentiates between five kinds of capital: financial, natural, produced, human, and social. All are stocks that have the capacity to produce flows of economically desirable outputs, their maintenance being "essential for the sustainability of economic development" (Goodwin, 2007). *Financial capital* refers to system of ownership or control of physical capital. It facilitates economic production but is not itself productive. *Natural capital* is made up of the resources and ecosystem services of the natural world. *Produced capital* is made up of physical assets generated by applying human productive activities to natural capital and capable of providing a flow of goods or services. *Human capital* refers to the productive capacities of an individual, both inherited and acquired through education and training, while *social capital*, consists of a stock of trust, mutual understanding, shared values and socially held knowledge. However not all capital can be classified clearly into only one form. E.g., when people deliberately create stocks of new seeds through selective breeding, such seeds may be seen as partly natural and partly produced – and also as embodying human and social knowledge (Goodwin, 2007).

Elaborating on *natural* and *social capital* Goodwin states: "It was from a largely homocentric point of view that economists first began to label stocks of clean water and air, as well as forests, fisheries, and the ever evolving systems that support them – and us – as *natural capital*. While the term was originally used only for those aspects of nature that humans were actually using – and especially the parts that they were depleting, such as fertile topsoil – growing awareness of the intricacy and delicate balance of the relationship between the natural environment and human

economies is encouraging many to think of our total natural environment as precious natural capital" (Goodwin, 2007).

Social Capital Today

According to Goodwin (2007) in present-day industrialized economies, recognition of *social capital* by economists is fairly recent, and has been strengthened by "the observation that variations in social capital across communities and societies can help to explain some of the differences in their economic development"(Goodwin, 2007). Social capital now frequently refers to those characteristics of a society that encourage cooperation among groups of people (e.g., workers and managers) whose joint, interdependent efforts are needed to achieve a common goal such as efficient production. Studies suggest that strong norms of reciprocity lead people to trust and to help one another, and that dense networks of civic participation encourage people to engage in mutually beneficial efforts rather than seeking only to gain individual advantage at the possible expense of others. *Social capital* furthermore, resembles other forms of capital in that it generates a service that enhances the output obtainable from other inputs, without itself being used up in the process of production. (Goodwin, 2007). To understand the notion of social capital, we must refer to institutions.

References

Costanza, R. and Daly, H., E. (1992): Natural Capital and Sustainable Development. *Conservation Biology* 6(1), pp.37-46.

Costanza, R. (Lead Author), Cleveland, C., J. (Topic Editor) (2008): Natural capital. In: Encyclopedia of Earth. In: Cleveland, C., J. (Eds), Encyclopedia of Earth [online] URL: http://www.eoearth.org/article/Natural_capital [First published in the Encyclopedia of Earth February 26, 2007; Last revised July 31, 2008; Retrieved February 4, 2010].

Goodwin, N. (Lead Author), Global Development and Environment Institute (Content Partner) and Cleveland, C., J. (Topic Editor) (2007): Capital. In: Cleveland, C., J. (Eds), Encyclopedia of Earth [online] URL: http://www.eoearth.org/article%20/Capital [First published in the Encyclopedia of Earth April 1, 2007; Last revised October 9, 2007; Retrieved January 14, 2010]

53. Natural Capital Depletion Tax

Background

Natural capital refers to the land, air, water, living organisms and all formations of the earth biosphere that provide us with ecosystem goods and services required for survival and well-being. It is also the basis for all human economic activity. It

comprises renewable resources and also exhaustible stocks on fossil fuels and minerals. We should be taxing what we want less of (like pollution or depletion of finite natural resources)?

Manufactured and human capital has traditionally been measured to calculate economic performance while natural capital has always been neglected, leading to loss of resources, the degradation of natural environments and the loss of valuable ecosystem services. Sustainability requires maintaining natural capital intact, or at least it requires to slow down its loss while waiting for positive technological changes and peak human population. In order to achieve this, an economic instrument to encourage the conservation of natural capital would be useful. One possibility is a natural capital depletion tax.

A proposed tax reform

Developed by ecological economists Robert Costanza and Herman Daly, executive and author Paul Hawken, and ecologist John Woodwell (1995,1998), their “ecological tax reform” proposal calls for a revenue neutral tax shift. In other words, it would not add to the total tax burden, and would even be compatible with tax reduction, but it would radically shift the target of taxation and replace much current income tax (and also taxes on labour in the form of social security contributions) with a "natural capital depletion tax".

The aim of the proposed tax reform is to provide incentives to use natural resources and ecosystems (natural capital) in a sustainable way. Consumption of natural capital would be taxed to the extent that materials are not recycled, encouraging "closed loop" use to the possible extent. For example, the use of fossil energy (which of course cannot be recycled) would be taxed but might be offset with credits for investment in renewable alternatives. This provision would encourage the development of energy efficient technology and renewable sources of energy.

According to the authors, shifting the tax burden from income (and labour) to pollution and depletion would benefit both the economy and the environment by encouraging employment and income, reducing the need for government regulation, and promoting the sustainable use of natural resources and ecosystems. The revenue neutral aspect of the tax shift would not raise costs for business, rather offering businesses appropriate incentives to develop new technologies, improving production efficiency and environmental performance.

Moreover, since the natural capital depletion tax would be applied mainly at the input side of the economy, the tax would pass through the whole system, influencing the prices of all goods and services that consumed natural capital, either directly or indirectly. This would encourage the development of products that do not consume natural capital, which would then have a competitive advantage in the marketplace and tend to displace their non-sustainable alternatives.

Winners and Losers

As often with tax reform proposals, there would be both winners and losers. Extractive industries for instance would probably be directly affected. Companies able to adapt however, would find new opportunities, and thus profits. In addition, because any consumption or value added tax has a regressive character, income transfers or other protections might be necessary to prevent the tax burden from falling too heavily on the poor. The Natural Capital Depletion Tax would particularly favour the raw materials exporting countries or regions.

Difficulties in implementation

The real strength of the proposal for a natural capital depletion tax is its potential to align a powerful economic tool with the physical reality of the world we inhabit. However most governments are reluctant to impose such taxes, particularly for fear of political unpopularity and damaging national competitiveness. Instead many countries in Latin America and Africa are forced to export cheap raw materials by the burden of the payments of the external debts, while industrial countries are emphasising policies of energy efficiency achieved through technological means (such as labelling, standards and best practice schemes), and deregulation of national fuel industries to bring about more competitive markets. These measures in industrial countries ironically are likely to create a rebound effect whereby lower energy prices lead to greater energy consumption, and increased economic growth.

The concept of natural capital depletion tax is problematic in that it is hard to see how the tax level could be rationally set when the total volume and accessibility or recoverability of a resource is unknown. As an example, the penalty level and urgency level of conservation is very different if the depletion rate appears to be 10%, 0.1% or 0.001% of the total resource per year. We are approaching peak oil and later peak gas. Proven reserves are depleted to a few decades-worth of production. Extraction should be taxed but then the rate of prospecting for other sources such as coal will increase until the companies feel secure again. The limits of exploiting living resources of the sea are perhaps more apparent, but procedures such as aquaculture and fertilising the sea may radically change equations and assumptions.

There is the also the matter of implementation: a system of natural capital depletion taxes would require an international agreement or cartels (such as OPEC) to prevent free market access to resources from countries with no natural capital depletion taxes.

References

Costanza, R., Daly H., Hawken P. and Woodwell, J., 1995. "Non-partisan ecological tax reform: a win-win proposal that is economically efficient, socially equitable, and ecologically sustainable". International Society for Ecological Economics Newsletter, 6:3, pp. 3 and 8.

S. Bernow, R. Costanza**,** H. Daly, R. DeGennaro, D. Erlandson, D. Ferris, P. Hawken, J. A. Horner, J. Lancelot, T. Marx, D. Norland, I. Peters, D. Roodman, C. Schneider, P. Shyamsundar, and J. Woodwell, 1998, Ecological tax reform, BioScience 48:193-196.

54. Needs

Maslow's pyramid

The notion of needs was initially developed in the field of psychology by Abraham Maslow to explain individual motivation process (Maslow, 1943). His "hierarchy of human needs" consisted of five needs, ranked in a pyramid (**Figure 1**) : physiological (hunger, thirst, warmth, sleep, etc), safety (protection, order, law, etc), belongingness and love (affection, family etc), esteem (competence, approval and recognition), and self-actualization needs (realising personal potential, self-fulfilment, seeking personal growth and peak experiences). The core principle according to his theory is that an upper need cannot be satisfied until those lower in the hierarchy are met.

Critiques

This hierarchy has been criticised from many angles. For example, individuals can have affection even if their physiological needs are not fully satisfied. Moreover, the model implies that only sufficiently well-off people can achieve self-actualization, which contradicts the realities of for example, poor artists who have developed well their individual potential. In the context of environmental protection (which this model regards as a self-actualization need) the hierarchical assumption has been used to justify the position that poor countries must first meet their basic needs before tackling environmental goals such as mitigating climate change (Furfari, 2007). This kind of reasoning tends to legitimate any kind of economic growth in poor countries,

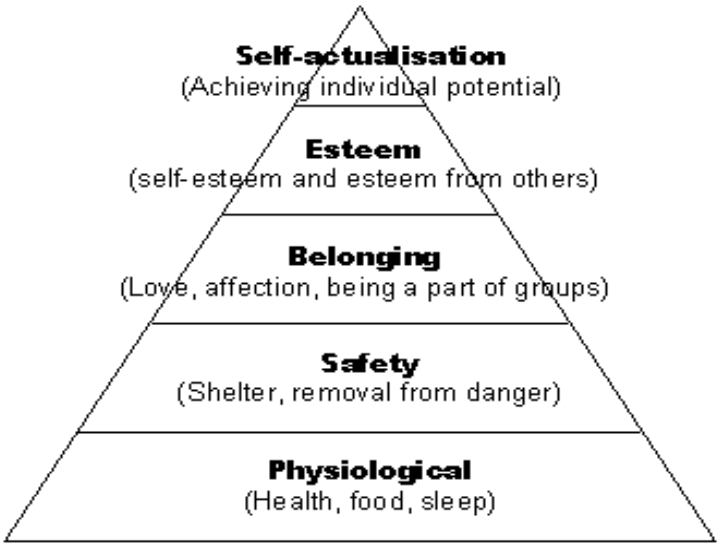


Figure 1 : Maslow's pyramid of needs
http://www.timlebon.com/maslow.htm

a strategy that is not shared by everyone, especially from a sustainability perspective.

NEEDS	Being (qualities)	Having (things)	Doing (actions)	Interacting (settings)
Subsistence	physical, emotional and mental health	food, shelter, work	work, feed, procreate, clothe, rest/sleep	living environment, social setting
Protection	care, adaptability, autonomy	social security, health systems, rights, family, work	cooperate, plan, prevent, help, cure, take care of	Living space, social environment, dwelling
Affection	respect, tolerance, sense of humor, generosity, sensuality	friendships, family, relationships with nature	share, take care of, make love, express emotions	privacy, intimate spaces of togetherness
Understanding	critical capacity, receptivity, curiosity, intuition	literature, teachers, educational and communication policies	analyse, study, meditate, investigate	schools, families, universities, communities
Participation	adaptability, receptivity, dedication, sense of humor	responsibilities, duties, work, rights, privileges	cooperate, propose, dissent, express opinions	associations, parties, churches, neighborhoods
Idleness	imagination, curiosity, tranquility, spontaneity	games, parties, spectacles, clubs, peace of mind	day-dream, play, remember, relax, have fun	landscapes, intimate spaces, places to be alone, free time
Creation	imagination, boldness, curiosity, inventiveness, autonomy, determination	skills, work, abilities, method, techniques	invent, build, design, work, compose, interpret	spaces for expression, workshops, audiences, cultural groups
Identity	sense of belonging, self- esteem, consistency	symbols, language, religion, values, work, customs, norms, habits, historical memory	get to know oneself, grow, commit oneself, recognize oneself	places one belongs to, everyday settings, maturation stages
Freedom	autonomy, passion, self-esteem, open-mindedness, tolerance	equal rights	dissent, choose, run risks, develop awareness, be different from, disobey	temporal / spatial plasticity (anywhere)

Table 1: Human scale development, Max Neef 2001
(Source: whiteweek.wordpress.com/)

Refinements by Max-Neef

In response to the limitations of a Maslow's hierarchy, Chilean ecological economist Manfred Max-Neef created his model of "Human scale development", aiming to build a human needs theory for development. For Max-Neef, "*fundamental human needs are finite, few and classifiable and are the same in all cultures and in all historical periods. What changes, both over time and through cultures, is the way or the*

means by which the needs are satisfied" (Max-Neef, 1991). Nine fundamental needs are identified (subsistence, protection, affection, understanding, participation, leisure, creation, identity and freedom). While there is some overlap between Max-Neef and Maslow with regard to the categories of needs (for example subsistence resembles physiological needs, protection is similar to safety, and affection is related to belongingness), Max-Neef rejects the hierarchical principle and considers fundamental human needs as a system where "*no need is more important per se than any other and* [where] *there is no fixed order of precedence in the actualization of needs (that need A, for instance, can only be met after need B has been satisfied)*" (Max-Neef, 1991: 49).

Max Neef's model is composed of two other variables (see **Table 1** below). Firstly, there are four "*satisfiers*", i.e. means to meet these needs: being (personal or collective attributes/qualities), having (institutions, norms and material things), doing (personal or collective actions) and interacting (settings). The second variable relates to "economic goods "defined as objects or artifacts affecting the efficiency of a satisfier, thus altering the threshold of actualization of a need, either in a positive or negative sense. With these variables it is possible to build a matrix of needs and satisfiers to diagnose the level of satisfaction of the nine needs in a specific group or society. The model can also be used to determine the satisfiers required for fulfilment of the needs of this group and, therefore, to conceive a strategy for development aimed at the actualization of human needs (Max-Neef, 1991).

Doyal and Gough (1991) have also developed a theory of human needs, considering their realization a precondition of a fulfilled life. In this model, two universal basic needs and eleven intermediate needs are identified.

Implications for sustainability

These recent models of needs have implications for well-being theory, at the individual and societal level, and in ecological economics (Jackson and Marks, 1999). Indeed, in Max-Neef's theory, unsatisfied needs are seen as poverties, broadening the concept of poverty to more than a lack of income and beyond monetary measures. Following this reasoning, development means the alleviation of multiple poverties and becomes the social analogue of individual self-actualization, relevant to both North and South (Dodds, 1997). Furthermore, by distinguishing basic needs from economic goods, a needs-based welfare conception puts in question the positive relationship between increased material consumption and increased satisfaction of needs, especially of non-material needs. Therefore it contradicts the conventional economic approach which regards needs as subjective desires and preferences that can be satisfied through consumer choices, questioning the primacy and the uni-dimensional role of economic growth in the improvement of human welfare. In terms of sustainability, this opens the door to arguments that environmental imperatives should not be viewed as constraints on human welfare and that the satisfaction of needs and development do not automatically imply

natural resource depletion.

References

Dodds, S., 1997. Towards a 'science of sustainability': Improving the way ecological economics understands well-being. *Ecological Economics,* 23, 95-111.

Doyal, L., Gough, I., 1991. *A Theory of Human Needs* , Macmillan, London.

Furfari, S., 2007. Le monde et l'énergie. Enjeux géopolitiques, Editions Technip, Paris.

Jackson, T., Marks, N., 1999. Consumption, sustainable welfare and human needs- with reference to UK expenditure patterns between 1954 and 1994. Ecological Economics, 38 (3), 421-441.

Maslow, A., 1943. A Theory of Human Motivation. Psychological Review, 50 (4), 370-96.

Max-Neef, M., 1991. Human Scale Development. Apex Press, New York.

55. NIMBY (Not in My Back Yard)

Definition and origins

NIMBY is an acronym for "not in my back yard". According to the Collins dictionary, people affected by the NIMBY syndrome are those who object to the occurrence of something if it will affect them or take place in their locality. For a long time, governments and corporations have built unwanted and/or hazardous projects (often in predominantly poor neighbourhoods), with little regard for public consultation or consideration. In order to defend their neighbourhoods, health, security and way of life, local communities had to band together in order to defend their local area against these decisions. Opposing residents themselves are sometimes referred to as "*Nimbies*".

NIMBY is characterized by intense, sometimes emotional, and often adamant local opposition to the situating of proposals that residents believe will result in adverse impacts. Project costs and risks, such as effects on human health, environmental quality, or property values, are geographically concentrated while the benefits accrue to a larger, more dispersed population. The recurrence of Nimbyism in recent years may be traced to the public's broad embrace of new environmental values and its fear of dreadful and unknown technological risks - such as hazardous waste, toxic substances, and nuclear power, as well as to a dramatic increase in publicly available information on health and environmental risks of proposed facilities. Additional factors are a decline of confidence in the ability of government and

industry to make informed, prudent, and equitable decisions about risky technologies, and statutory creation of new opportunities for public participation in administrative and judicial processes.

Almost all of the literature that deals explicitly with the NIMBY syndrome (published since the late 1980s) originates from the USA. The term is widely used by those involved in or commenting upon local development disputes, but is also used to discredit project opponents, pejoratively describing opposition and undermining the legitimacy of community assertions against proposals such as those for nearby tall buildings, wind turbines, incinerators, power plants, mobile phone network masts, new roads or railways. People using the expression NIMBY consider opponents to new projects as having a narrow and selfish view of the situation. In the Southern context however it has a very different meaning which is strongly linked to community power and grassroots democracy. Since NIMBY, many expressions have emerged around locally focused social movements: NOOS (Not On Our Street) ; LULU (Locally Unwanted Land Uses) ; NIABY (Not In Anyone's Backyard) ; NOPE (Not On Planet Earth) ; NIMTOO – (Not In My Term Of Office) ; CAVE (Citizens Against Virtually Everything) ; GOOMBY (Get Out Of My Backyard); NOTE (Not Over There Either) ; and BANANA (Build Absolutely Nothing Anywhere Near Anyone).

Approaches to NIMBY

Both the scholarly literature and recent politics reveal two kinds of responses to the rise of NIMBY, one highly critical and one fairly positive. The former is clearly the predominant view. Critics of the NIMBY response argue that as a result of the social and political developments noted, essential projects have become impossible to situate, thus restricting or delaying local economic development and technically superior solutions to problems such as hazardous waste disposal. Nimbies are seen as small groups skewing the system in their favour; using political opportunities to obtain outcomes that suit them at the expense of other people and their rights. In this way they selfishly erode the rights of the larger community.

The figure below offers a model of this conventional view of the NIMBY phenomenon:

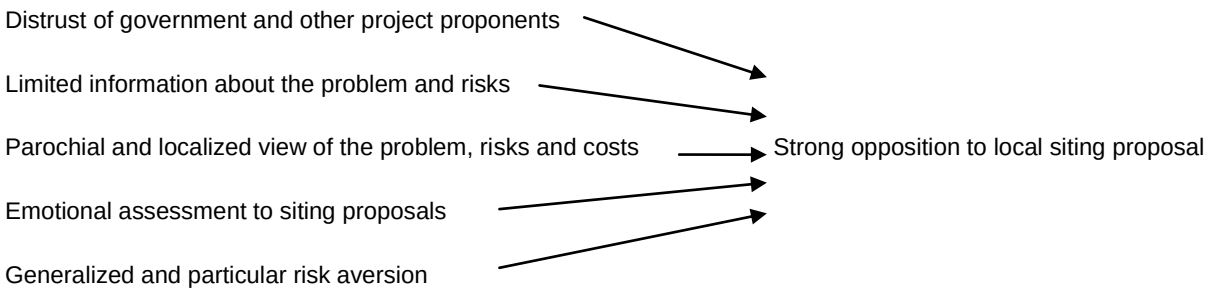


Figure 1 Citizen Participation and the Nimby Syndrome: Public Response to Radioactive Waste Disposal

(Source: Kraft & Clary, 1991)

The more positive assessments of NIMBY politics suggest that the public's position on siting issues may be rational and politically legitimate. Citizens may have a fairly good grasp of the issues and a reasonable concern for genuine risks to community health and welfare that are ignored by technical and administrative elites. From this perspective, local opposition may serve a broader public interest, for example in identifying important weaknesses in expert analyses underlying siting proposals (see post-normal science) and forcing consideration of a broader range of sites, some of which may be more technically suitable. NIMBY protests are essentially clashes of incommensurable values, and clashes over whose values can be legitimately expressed. Such conflicts are often the only way citizens can express their concerns and influence government policy.

In 1971 in Australia, a small group of concerned local women from Hunters Hill joined together in order to conserve the last remaining bush land on the Parramatta river known as Kellys Bush (Mundey). This group combined with the Builders Labourers Federation (BLF) to oppose the planned development on the site. The BLF put a development ban on Kelly's Bush, preventing a high-density development and this ban became known as a Green Ban. From there Green Bans 'mushroomed' under the BLF and a number of significant sites were preserved, including the Rocks area and Centennial Park in Sydney. The emergence of Green Bans highlights how a local group made a difference, not only in their local community, but also in broader society. They were the catalyst for the formation of a larger social movement and had a much broader impact in the long term.

Examples such as the one cited above illustrate a broadening and deepening of public involvement in decision-making, especially through innovative mechanisms of education and participation which offer significant political influence to citizens and promote a cooperative search for solutions. We argue that policies on technological risks should be based on democratic principles to promote a number of important objectives: to encourage technical review by a diverse set of policy actors, to facilitate consideration of public fears and concerns, and to build public support for policy implementation. Despite its now frequent occurrence in a diversity of settings, there have been few rigorous efforts to conceptualize the NIMBY response or to assess its policy implications, and only a handful of empirical studies that help to clarify its behavioral and political dynamics.

Ban the term NIMBY?

Although many people might be cynical of their motivations and although some Nimbies are motivated by fear of outsiders and protecting their assets, most NIMBYs actually try to create change at a local level and seek to create better communities. The fact that these groups can be found around the world indicates that there is a broader element to their objectives and in this sense they might be considered an immature expression of a social movement, which under the right conditions and leadership could expand into a fully-fledged social movement. NIMBYs are a result of and reaction to a local political and social context. Their meaning, shape, size and definition are all relative to these contexts, as well as to the individual personalities involved. They share a sense of community and as a result also shape the identity of the people involved. In contrast with the negative depiction of NIMBYism, local

resistance can be viewed as an essential starting point and ongoing component of dynamic environmental movements. However, given that the term NIMBYism has come to be synonymous with limited, selfish or irrational responses, continuing to describe local

Figure 1: March organized by residents and farmers against a project of landfill, Essonne, France
(Source: www.adse-saintescobille.com)

protesters as NIMBYs makes little sense given growing recognition of the diversity of concerns typically raised, factors which constrain local responses, the inevitability of attempts to protect one's own backyard as inevitable and perhaps even environmentally positive.

References

Brion (1991) *Essential industry and the NIMBY phenomenon*. Quorum Books, New York.

Burningham K (2000) *Using the language of NIMBY : a topic for research, not an activity for researchers. Local Environment*, vol 5, n°1, 55-67.

Dear M (1992) *Understanding and overcoming the NIMBY syndrome*. *Journal of the American Planning Association*, Vol. 58.

Kraft ME & Clary BB (1991) *Citizen Participation and the Nimby Syndrome: Public Response to Radioactive Waste Disposal*. *The Western Political Quarterly*, Vol. 44, No. 2, 299-328, University of Utah, Western Political Science Association.

Wolsink M (2000) *Wind power and the NIMBY-myth : institutional capacity and the limited significance of public support*. *Renewable energy*, vol. 21, n°1, 49-64.

http://www.nimbyexperts.com

56. Opportunity Cost

Definition

Opportunity cost is one of the most basic concepts in economics. A fundamental rule in economics is “never do anything unless it is worth more than its opportunity cost”. Opportunity cost expresses the idea that for every choice, the true economic cost is the sacrifice of the next best opportunity. Or, in other words, the opportunity cost is the net benefit forgone because the resource providing the service can no longer be used in its next-most-beneficial use. As an example, suppose a farmer cuts down a forest to expand his cropland. If the consequent loss of timber, firewood, and water purification function is the next best use of the land, then the value of timber, firewood, and water purification is the opportunity cost of the expanded cropland. Another example would be the choice to use a particular section of a river either for canoeing or to generate electric power. Since the dam needed to generate power would flood the rapids, the two uses are incompatible. The opportunity cost of producing power is the foregone net benefit of canoeing.

Opportunity cost and resource scarcity

The concept of opportunity cost is linked to the notion of scarcity of resources. Indeed, the economic system has a certain endowment of relatively scarce resources (land, industrial machinery, raw materials, labour). Each use implies an opportunity cost from using the resource for one use rather than for another competing one. If someone chooses to spend time resting rather than making a bookshelf, the opportunity cost is the value of that bookshelf that might have been produced. Time is the scarce resource; using it to rest entails a clear loss of opportunity for shelf-making. Thus, opportunity costs are not restricted to monetary or financial costs: the real cost of output forgone, lost time, pleasure or any other benefit should also be considered as opportunity costs.

It can also be used to measure the economic effect of the rising scarcity of a natural resource by computing how much a society must give up to obtain an additional unit of the resource. Moreover, differences in resource quality affect the economy through the opportunity cost. Opportunity cost is equal to the goods and services that cannot be produced because energy is used to produce an alternative good or service. For example, energy used to harvest timber cannot be used to heat a home.

Uses

The opportunity cost approach is a very useful technique when benefits of certain uses, such as preservation, protection of habitats, cultural or historical sites, cannot be directly evaluated. For example, the cost of preserving forests for a national park rather than harvesting them for timber would be assessed by using the forgone

income from selling timber. Similarly, in the Yasuni ITT proposal in Ecuador in 2007, the government was ready to forego the revenue from the extraction of 850 million barrels of oil (taking into account the benefits from conservation of biodiversity, the rights on the indigenous population, and the carbon dioxide emissions avoided), but the government asked for external contributions from other countries to cover half the "opportunity cost" (that is, half the foregone revenues that would be obtained by extracting and selling the oil).

Issues

In this way opportunity cost plays a crucial part in ensuring that scarce resources are used efficiently. It has been described as expressing "the basic relationship between scarcity and choice." However, we must point out that difficulties in assessing the benefits from environmental preservation can lead to the inefficient allocation of resources. The concept of opportunity cost is also at the heart of a debate between standard (environmental) economics and ecological economics in the way they see the world. While the former sees the economy as the whole, drawing from nature or the environment as sectors of the macroeconomy (forests, fisheries, grassland, mines, wells, ecotourist sites, and so on), the latter envisions the (macro) economy as a part of a whole, namely the earth, its ecosystems and its atmosphere, within a finite, non-growing and materially closed ecosystem.

Starting from this point, if the economy grew in a void (as it does according to standard economics), it would encroach on nothing and its growth would have no opportunity cost so that it could expand without limit. But since the economy grows into a finite ecosystem, the growth of the macroeconomy overlaps onto the non-growing whole, implying a sacrifice of something (the opportunity cost). Thus growth *does* have a cost and, at some point the continued growth of the macroeconomy will cost us more than it is worth. This is what is referred to (in Herman Daly's words) as uneconomic growth. In a situation where the economy was very small relative to the ecosystem (as in pre-industrial times), there would be no need to stop growing since resources would be abundant and the opportunity cost for economic expansion would be insignificant. But in the long run, with continued growth, we would arrive at state in which the opportunity cost of growth was significant. According to many ecological economists and advocates of sustainable economic degrowth, we are already in such a situation.

References

H. E. Daly, 2007, *Ecological Economics and Sustainable Development, Selected Essays of Herman Daly*, Northampton MA: Edward Elgar Publishing.

T. M. Crowards, 1998, Safe Minimum Standards: Costs and Opportunities, *Ecological Economics*, vol. 25 (3), pp. 303-314.

James M. Buchanan, 1987, Opportunity Cost, The New Palgrave: A Dictionary of Economics, vol. 3, pp. 718–21.

Websites

http://www.eoearth.org/article

http://www.ecoeco.org/education_encyclopedia.php

57. Participative Democracy and Public Participation

From theories of democracy…

The origins of 'democracy', wherein the power ('kratos') is exerted by the people ('demos'), may be traced back to ancient Greece. Since Plato and Aristotle, many prominent thinkers have added to an array of theories of democracy, such as Locke, Rousseau, Mill, Dewey, Pateman, Habermas and Dryzek. Democracy has become the internationally predominant system of governance, a 'universal value', according to Sen (1999). He argues that democracy has a plurality of virtues, including: i) the 'intrinsic' meaning of political participation and freedom to achieve human wellbeing, ii) the 'instrumental' importance of assuring governments' responsibility and accountability, and iii) the 'constructive' role in value formation and understanding the needs, rights and duties of citizens.

Varied forms of political government have been advocated, from 'direct democracy´, where the citizens exert the decisions directly, to the widespread system of 'representative democracy', where elected representatives act in the interest of the people. Many scholars call for extensive participation and a more meaningful engagement of the public in modern nation-states, to avoid narrowing the practice of representative democracy to voting in elections (NRC, 2008).

In this context, 'participatory democracy' has emerged as a catchphrase for more genuine, popular or progressive forms of democratization. Aragonès and Sánchez-Pagés (2009) define it as a process of collective decision-making where citizens have the power to decide on policy proposals and politicians assume the role of policy implementation. Participatory democracy provides opportunities to overcome the shortcomings of representative democracy by combining it with elements of direct democracy. In this system, citizens lead by making a policy proposal, which the elected representatives may subsequently decide to implement. The notion of a reduced scale of government is an integral element of the definition of participatory democracy, which taps into the notion of subsidiarity.

The theory of democracy has recently taken a 'deliberative turn', whereby democratic legitimacy increasingly rests on authentic deliberation rather than on

voting or interest aggregation. “Deliberative democracy” has supporters and detractors. According to the former, deliberation induces individuals to reflect upon their interests and preferences, becoming amenable to changinging them and reach a workable agreement that follows a certain decision rule (e.g. consensus, unanimity, or majority). Critics however, argue that deliberative democracy favours conditions for strategic behaviour and fosters chaotic and arbitrary outcomes.

…To theories of participation

Public participation is intrinsic to democratic governance. Hence, theories of democracy have in turn led to theories of public participation (NRC, 2008). Renn and Schweizer (2009) reviewed these theories, proposing six broad theoretical concepts categorizing the processes that channel public input into public policy making:

- **Functionalist**, where participation aims to improve quality of decision output, and follows a rationale that argues for representation of all knowledge carriers, integrating systematic, experiential and local knowledge;

- **Neo-liberal**, which aims to represent all values and preferences in proportion to their share in the affected population, thus focusing primarily in the collection and representation of (well-informed) public preferences;

- **Deliberative**, where competition between participants’ arguments is promoted with respect to criteria of truth and normative validity, reaching consensus through argumentation;

- **Anthropological**, which is based on the belief that common sense is the best judge in reconciling competing knowledge and value claims, thus promoting the inclusion of non-interested laypersons representing social categories such as gender, income and locality;

- **Emancipatory**, where the goal is to empower less privileged groups and individuals, by strengthening the resources of those who are more negatively affected and challenging traditional power structures in society;

- **Post-modern**, whereby participation aims to demonstrate variability, plurality and legitimacy of dissent, thus leaning towards acknowledgement of plural rationalities. Within this concept, mutually acceptable arrangements are sufficient and there is no need to reach a final product or joint statement (i.e. reaching closure).

The justifications for active public involvement in decision-making processes can be aggregated into three categories: i) normative reasons – both society and individual citizens are enriched through the encouragement of social and individual learning, ii) substantive reasons – accommodating multiple views improves understanding of the issues and subsequently the selection of more appropriate solutions; iii) instrumental reasons – success of policy implementation is promoted through the encouragement of collaborative relationships.

Forms of public participation

In democratic societies, people participate through different ways, such as voting, expressing opinions on public issues and governmental actions, forming interest groups, influencing decisions by demonstrating or lobbying, filing lawsuits to contest actions, establishing partnerships with government agencies or mobilizing attention to issues through artistic expression (NRC, 2008). All these forms fall under a broad definition of 'public participation', whereby public concerns are integrated, to a lesser or greater extent, into governmental or corporate decision-making.

In the context of environmental assessment and decision-making, 'public participation' usually refers to a narrower conception describing any "organized process adopted by elected officials, government agencies, or other public or private – sector organizations to engage the public in environmental assessment, planning, decision-making, management, monitoring, and evaluation. These processes supplement the traditional modes of public participation…(such as those in electoral and legislative processes)" (NRC, 2008).

There are multiple and sometimes conflicting interpretations of 'who' is involved in 'public participation' and 'stakeholder participation'. The former term often refers to individual citizens or relatively unorganized groups of individuals, while the latter usually involves organized groups with a vested interest in a decision. However, some authors prefer to merely use the label 'public participation', applying it to the full range of interested and affected parties:

- **General public**, all individuals who are not directly affected by the issue, although they may be part of public opinion on it;
- **Observing public**, which includes the media, cultural elites and opinion leaders who may comment on the issue;
- **Directly affected public**, including individuals and unorganized groups that experience direct, positive or negative, effects from the policy outcome;
- **Stakeholders**, the organized groups which are or will be affected by or that have a strong interest in the outcome of a decision.

Therefore, the key message is to employ a clear terminology and distinguish between the different types of target 'publics' to involve in a participatory process.

Practical issues in the design and implementation of participatory processes

Taking stock of a growing body of literature on public participation in environmental assessment and decision-making, several authors (e.g. Antunes et al., 2009; NRC, 2008) have proposed a set of critical issues to be considered in the setup, design and management of participatory processes.

At an inception stage, government agencies should cater for (NRC, 2008): i) clarity of purpose, ii) a commitment to use results in decision-making, iii) appropriacy of funding and staff, iv) appropriate timing of participation in relation to decisions, and v) a commitment to self-assessment and learning. One of the critical decisions to be made during process setup concerns selecting the desired level of intensity and

influence of public input on decisions. The options are often represented along a 'spectrum of participation impact', ranging from information and consultation, to involvement, collaboration and empowerment (**Figure 1**).

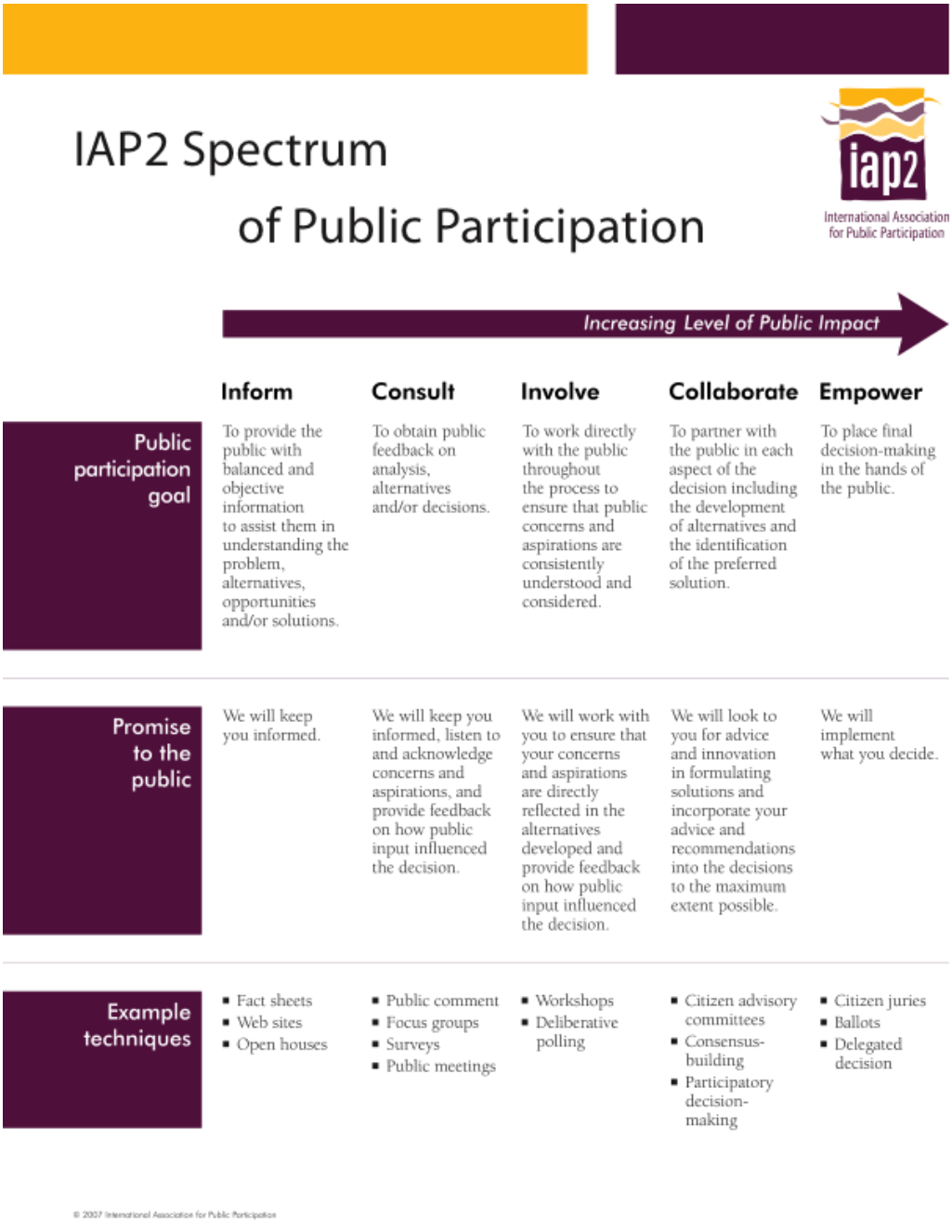


Figure 1: Spectrum of public participation impact
(Source: IAP2, 2007)

In designing the process, close attention should be paid to the relationship between the level of participation impact and the participatory methods deployed. There are no clear-cut solutions, although certain tools and techniques fit particularly well to specific contexts, purpose and desired level of participation impact, as suggested by **Figure 1**. The options for the implementation of a participatory process include a variety of methods and tools, thoroughly reviewed in several studies. Furthermore, process design should be guided by the principles of inclusiveness, collaborative problem formulation, transparency and good-faith communication (NRC, 2008).
Finally, the management of scientific inputs and multiple information sources in a participatory process is another issue of utmost importance and considerable debate. This resonates with the Post-Normal Science framework, according to which knowledge needs to be increasingly 'democratized' in complex decision processes, paying attention to the multiple legitimate perspectives of 'expert' and 'lay' constituencies, and considering both facts and values. As argued by Vatn (2009) participatory methods and deliberation represent rule structures that facilitate the articulation of participants' values. Management of information and quality assurance are then critical features of participatory processes, guided by principles of inclusiveness, socially robustness of knowledge, and transparency.

Participatory democracy in practice...
Illustrations of various forms of participatory and deliberative democracy in action may be found in the experiences of 'participatory budgeting' in Porto Alegre, Brazil (Aragonès and Sánchez-Pagés, 2009), in the reform of public education systems in Chicago, USA, and in the governance of local villages in India (see the CEECEC case study on Hiware Bazaar). With the emergence of alternative ways of conceiving the so-called 'progressive' forms of democracy, the opportunities for public participation will continue to expand in increasingly decentralized, interdependent and networked democratic societies (NRC, 2008).

References

Antunes, P., Kallis, G., Videira, N., Santos, R., 2009. Participation and evaluation for sustainable river basin governance. *Ecological Economics*, 68, 931–939.

Aragonès, E., Sánchez-Pagés, S., 2009. A theory of participatory democracy based on the real case of Porto Alegre. *European Economic Review*, 53, 56-72.

Dewey, J., 1927. *The Public and its Problems*. Holt: New York.

Dryzek, J., 2000. *Deliberative democracy and beyond: liberals, critics, contestations*. Oxford University Press: Oxford, UK.

Habermas, J., 1984. *The Theory of Communicative Action*. Beacon Press: Boston, USA.

Locke, J., 1960. *An essay concerning human understanding*. Available from http://en.wikisource.org/wiki/Author:John_Locke

Mill, J., 1861. *Utilitarianism*. Available from http://www.gutenberg.org/etext/11224

NRC – National Research Council of the National Academies, 2008. *Public Participation in Environmental Assessment and Decision Making*. Panel on Public Participation in Environmental Assessment and Decision Making, Thomas Dietz and Paul C. Stern, eds. Committee on the Human Dimensions of Global Change. Division of Behavioral and Social Sciences and Education, The National Academies Press: Washington DC, USA.

Pateman, C., 1970. *Participation and Democratic Theory*. Cambridge University Press: Cambridge, UK.

Reed, M., 2008. Stakeholder participation for environmental management: A literature review, *Biological Conservation*, 141, 2417–2431.

Renn, O., Scheizer, P.J., 2009. Inclusive Risk Governance: Concepts and Application to Environmental Policy Making. *Environmental Policy and Governance*, 19, 174–185.

Rousseau, J., 1762. *The Social Contract Or Principles Of Political Right*. Available from http://www.constitution.org/jjr/socon.htm

Sen, A., 1999. Democracy as a Universal Value. *Journal of Democracy*, 10, 3, 3-17.

Vatn, A., 2009. An institutional analysis of methods for environmental appraisal, *Ecological Economics*, 68, 2207–2215.

Websites:

http://www.citizens-initiative.eu

http://www.iap2.org

http://democraciaparticipativa.net

IAP2 – International Association for Public Participation, 2006. IAP2's Public Participation Toolbox, Available from http://www.iap2.org/

IAP2 – International Association for Public Participation, 2007. Spectrum of Public Participation, Available from http://www.iap2.org/

58. Payment for Environmental / Ecosystem Services

Definition

Ecosystems provide services to humanity such as clean water, climate stabilization and protection from storms and erosion (IUCN, 2008). Ecosystem services refers to the many natural processes by which ecosystems, and the species that make them up, sustain and fulfil human life, generating benefits for people, including commodities and regulating, supporting, and cultural services. The type, quality, and quantity of services provided by an ecosystem can be affected by the resource use decisions of individuals and communities. When the benefits of an ecosystem service flow primarily to others than those who make management decisions, public interests and the interests of the resource manager may be misaligned. ‘‘Payments for ecosystem services’’ (PES) have emerged as a policy solution for realigning the private and social benefits that result from decisions related to the environment. The goal of this instrument is to make landowners and resource managers internalize the benefits that they generate for society. Think of a highland landowner that allows cattle near the water sources – the PES will compensate him for the opportunity cost of foregoing having cattle in those areas.

Implementation

PES is an incentive-based mechanism, whose approach is based on a theoretically straightforward proposition: pay individuals or communities to undertake actions that increase levels of desired ecosystem services. A formal definition has been given by Wunder (2007): ‘‘A PES scheme, simply stated, is a voluntary, conditional agreement between at least one ‘seller’ and one ‘buyer’ over a well defined environmental service - or a land use presumed to produce that service’’. A simplified representation of PES schemes can be found at http://www.fao.org/ES/ESA/pesal/aboutPES5.html. The common aspects in several definitions refer to voluntary transactions where:

1. a service provider is paid by or on behalf of service beneficiaries,
for agricultural land, forestry, coastal or marine management practices,

that are:

2. expected to result in continued or improved service provision beyond what would have been provided without the payment.

PES schemes encompass a diversity of mechanisms ranging from voluntary compensation schemes for forest maintenance or agro-silvopastoral practices in Central America, to non-voluntary compensation for reforestation in China and Vietnam, and sometimes agro-environmental subsidies and certification schemes in the European Union and the United States. Latin America (Costa Rica, Ecuador, Mexico and Colombia) has been particularly receptive to this approach (Pagiola et al, 2005). In Europe, a PES initiative was developed and implemented by Vittel (Nestlé Waters) in North-Eastern France. REDD and other forms of carbon trade may be understood as PES.

Types of Schemes

According to FAO (http://www.fao.org/ES/ESA/pesal/aboutPES5.html) there are different types of Payments for Environmental Services schemes, namely:

a) Direct payment schemes: the government pays landowners, on behalf of civil society, and sometimes with contributions from the private sector, to adopt improved land management options and thus address a particular environmental problem.
b) Product-based PES schemes: consumers pay a "green premium" in addition to the market price of a product or service, in order to ensure an environmentally friendly production process and the protection of environmental services, which is verified through independent certification.

In the past decade, payment for ecosystem service (PES) schemes have represented a growing trend in conservation policy, developing rapidly in both developed and developing countries around the world (Wunder et al, 2008), mainly around three groups of environmental services:

- water quality and quantity, often including soil conservation measures in order to control erosion and sediment loads in rivers and reservoirs and to reduce the risk of land slides and flooding;
- carbon sequestration (and in some cases protection of carbon storage) to respond to demand from the voluntary and regulatory greenhouse gas emissions markets;
- biodiversity conservation, by sponsoring the conservation of areas of important biodiversity (in buffer zones of protected areas, biological corridors or even in remnant patches of native vegetation in productive farms) and protecting agricultural biodiversity.

PES is sometimes referred to as a “market-based instrument” or a “market for ecosystem services”, since it is basically a new type of subsidy, but unlike traditional subsidies, which are financed by taxpayers at large, payments can be financed directly and voluntarily by the beneficiaries (users) of the ecosystem services PES

help maintain.

They are applied at different scales, ranging from micro-watersheds to entire watersheds that may cut across state, provincial, or national boundaries. WWF is exploring the possibility of a transboundary scheme for the Danube River. In Costa Rica, a country-wide program has been implemented since 1997. A government agency is in charge of this program as a representative of the beneficiaries. All landowners that produce one of the ecosystem services listed in the law are potential participants of the program. In other places, small scale programs have been developed to solve specific problems such as water provision (Echaverria et al, 2004): water consumers in a locality pay landowners upstream to protect watersheds.

Issues

Payments for ecosystem services should not be seen as an end in itself, but it is a policy tool with several advantages (see, for example, UNEP website):

- potential to raise awareness of the values of biodiversity and ecosystems.

- opportunity to engage previously uninvolved actors (especially in the private sector) in conservation activities.

- opportunities for communities to improve their livelihoods through access to new markets.

- potential platform to integrate conservation and climate efforts into a common policy framework.

- potential to increase collaboration amongst Multilateral Environmental Agreements, in the international context.

- facilitates the transition from an economy of production to an economy of stewardship.

While the principles are clear, however, designing and implementing a system of payments for environmental services in practice is often difficult. PES programs in place differ substantially, reflecting the adaptation of the basic concept to very different ecological, socioeconomic, or institutional conditions, as well as design options, sometimes as a consequence of mistakes or the need to accommodate political pressures. PES can be viewed from 'urban-rural', 'upstream- downstream', 'North-South' and 'core-periphery' perspectives.

Echavarria et al (2004) describe a PES development process in ten steps, which may not be sequential: 1. Identify a situation where there is a "seller" and "buyer" of an environmental/ecological service; 2. Create the institutional capacity to implement a market mechanism; 3. Develop inter-institutional links; 4. Know what is going to be sold; 5. Develop and implement a negotiation strategy with the political decision-

makers; 6. Develop environmental education projects for the communities; 7. Develop a formal and transparent organisational structure for decision-making and implementation; 8. Establish an appropriate payment system; 9. Monitor and evaluate the process; 10. Make corrections and reinforce successful measures.

Gómez-Baggethun et al (2010) point that the focus on monetary valuation and payment schemes has contributed to attract political support for conservation, but also to commodify a growing number of ecosystem services and to impose the market logic to tackle environmental problems. In this context, some problems are referred in the literature in both the demand and the supply sides (Wunder, 2007; Kosoy et al, 2007). It is argued that PES may become counterproductive. Assume that the service (for instance, water supply from the highlands) was supplied as a matter of course and as a social obligation for free. When a system of payment is introduced to guarantee quantity and quality of water, the logic has changed. If the payments are now seen as insufficient, appeals to social obligation will be useless.

A critical dimension of PES systems concerns their impact on the poor. According to Pagiola et al (2005), PES may reduce poverty by making payments to poor natural resource managers. Although PES programs are not designed for poverty reduction, there can be important synergies when program design is well thought out and local conditions are favourable. However, payment mechanisms are limited for addressing issues of equity (Echavarria et al, 2004). They may eventually lead to changes in property rights against the poor or against indigenous groups.

Previous experience with incentive-based approaches suggests it is unlikely a PES approach will always be able to simultaneously improve livelihoods, increase ecosystem services, and reduce costs. Potential tradeoffs among these goals can arise and must be assessed (e.g. Kosoy et al, 2007; Jack et al, 2008).

References

Echavarria, M., Vogel, J., Albán, M., Meneses, F. 2004. The impacts of payments for watershed services in Ecuador - emerging lessons from Pimampiro and Cuenca. International Institute for Environment and Development (IIED), Environmental Economics Programme, London, UK.

Gómez-Baggethun, E., de Groot, R., Lomas, P., Montes, C. 2009 The history of ecosystem services in economic theory and practice: From early notions to markets and payment schemes, *Ecological Economics* (2009), doi:10.1016/j.ecolecon.2009.11.007.

IUCN. 2008. Designing Payments for Ecosystem Services. Report from the East Asian Regional Workshop (Hanoi, April 2008).

Kosoy, N., Martínez-Tuna, M., Muradian, R., Martínez-Alier, J. 2007. Payments for environmental services in watersheds: insights from a comparative study of three cases in Central America, *Ecological Economics*, Vol. 61, 446-455.

Pagiola, S., Arcenas, A., Platais, G. 2005. Can payments for environmental services help reduce poverty? An exploration of the issues and the evidence to date from Latin America. World Development 33 (2) 237-253.

Wunder, S. (2007) Efficiency of Payments for Environmental Services. *Conservation Biology*, Volume 21, No.1, February 2007.

Wunder, S., Engelb, S., Pagiola, S. 2008. Taking stock: A comparative analysis of payments for environmental services programs in developed and developing countries, Ecological Economics, vol. 65, 834-852.

Websites

http://www.fao.org/ES/esa/pesal/index.html

http://www.cbd.int/financial/payment.shtml

http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/ENVIRONMENT/EXTEEI/0,,contentMDK:20487926~menuPK:1187844~pagePK:210058~piPK:210062~theSitePK:408050,00.html

59. Peak Oil

Background

Modern industrialized economies are highly dependent on a variety of non-renewable resources. The scarcity and depletion of some of them had already been a major subject of concern for thinkers and economists in the past, as fertile land was for Malthus (1798) or coal for Jevons (1865). These considerations were dismissed by the next generations of economists when the potentials of fertilizers and petroleum became evident, facilitating the emergence of modern agriculture. It would take until the 1970s with its two consecutive oil-shocks and the publication of *The* entropy law *and the economic process* (Georgescu-Roegen 1971), *The limits to growth* (Meadows, Meadows et al. 1972), and other books by H.T. Odum, Barry Commoner, F. Schumacher, for the debate to awaken again.

Definition

Today, with the depletion of “proved reserves” of oil being only 40.5 years away at current consumption rates (BP 2008), the debate around the limits of non-renewable resources is seemingly becoming less marginalised and abstract. However, its point

of departure, namely *depletion*, is ill-conceived. The critical moment for human society is not when the last drop of oil will be extracted; in fact this will never happen. One hundred percent recovery of most resources is physically and economically impossible. Conventional petroleum fields for example usually have an average recovery rate of only around 35%. Instead, the critical point is that of maximum or peak extraction, as this is the point when the resource stops being “cheap”. Prices will increase not only because demand will continuously outstrip supply but also because the second half of the remaining resource is usually of a lesser quality, more difficult to extract and/or in politically unstable regions (e.g. Nigeria).

In the case of petroleum, this phenomenon is today referred to as *Peak Oil* and was first described by petroleum geologist M. King Hubbert (1949). He argued that production peaks in the form of bell shaped curves that could be observed for individual oil fields, would eventually occur for entire oil regions, countries and eventually the world. These production peaks and the shape of the curve could be predicted mirroring the discovery peak curve. However, several “resource conditions” must hold:

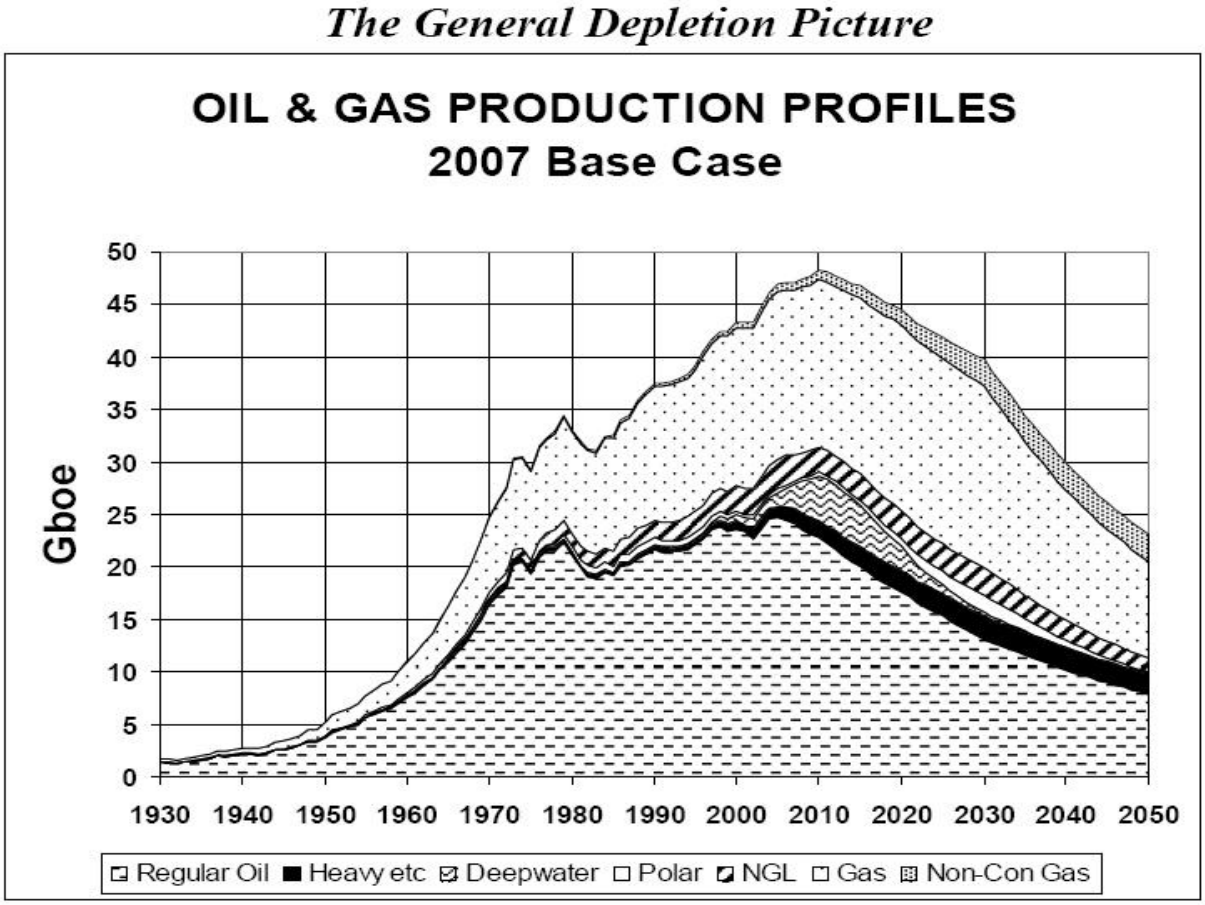


Figure 1: Source: ASPO

First, the resource must be key, so that demand for it rises steadily over time. In fact, it could be argued that the abundance of some resources and therefore their relative cheapness in

itself stimulates further increased demand in the first place. This initial abundance gives way to an increasing amount of applications. Second, substitution must be costly, difficult or impossible. Third, market access to the resource must be granted i.e. extraction is allowed by the resource owner (usually nation states). The more important the resource, the higher the international pressure on resource owners to grant this access. Finally, reasonable profits must be able to be gained by the entity (state or a private company) involved in extracting the resource. The higher the profits involved, the larger is the incentive for a resource owner to grant access. The US was a role model for satisfying all these conditions. Discovery had peaked in the 1930s, which allowed Hubbert (1956) to predict the US peak for the lower 48 US states for 1971, being only a few months off the actual peak in October 1970. Resource conditions, which diverge from those described (e.g. the owner does not grant access for political reasons), can lead to depletion curves which differ from that described by Hubbert, at least over the short run.

Today the Peak-Oil debate has become quite lively (Hirsch 2005). Fundamental disagreement exists over the question of *when* peak oil is going to happen and *how important* it is going to be for the world economy. On the one hand there are the "geologists" which are also referred to as the "pessimists" because they argue that Peak Oil is more or less imminent and will have devastating consequences for human society (e.g. Campbell and Laherrere 1998). This position is close to that of ecological economists, who generally believe in the absolute scarcity of low entropy resources (e.g. Georgescu-Roegen 1971).

On the other hand there are the "optimists" who argue that market forces, driving up oil prices when scarcity increases, will lead to increased exploration and will inspire human ingenuity to develop substitutes and alternatives for oil. This group is also referred to as the "economists", because market forces and technological change are believed to render Peak Oil a mere anecdote without any potential for causing a major enduring economic. In line with this reasoning Saudi Oil Minister Sheikh Ahmed Zaki Yamani famously said: "The Stone Age came to an end not for a lack of stones and the oil age will end, but not for a lack of oil."

A very important argument made by the "pessimists" is that, since every system has its particular energy source, the system will change radically once this resource. This is to counter those who believe we can easily substitute oil and gas as major energy sources, with for example, shale oil, tar sands, nuclear energy or renewable energy (agro-fuels, wind, solar, geothermal). If the properties of the potential new energy source are different in terms of net energy (Odum 1971) or Energy-Return On Investment (EROI), which is essentially the case for the alternatives to oil and gas that we know of, then the human economic system is bound to change radically.

Other important concepts within ecological economics are those of post-normal science and complexity, relevant to Peak-Oil as far as the *technological optimism* of the "economists" mentioned above is concerned. The positivistic belief that all human problems have technological solutions that can be devised by human ingenuity seems to contribute to the fact that Peak-Oil has not been featured as an urgent issue in the appropriate arenas. Economics textbooks have not mentioned Peak-Oil, as they could and should have done since 1950. In reality most technological advances of our society are results of and dependent on the enormous energy affluence provided by fossil fuels.

Finally Peak-Oil has important implication for the conflicts that take place at the "commodity frontiers". This is not only of relevance for the exploration of oil, which is pushing further into so far untouched environments (as in certain parts of the Amazon forests or Alaska) but also for most other raw materials.

References

BP. (2008). " Oil reserves." http://www.bp.com/sectiongenericarticle.do?categoryId=9017934&contentId=7033489 Retrieved 1st April, 2008.

Campbell, C. and J. Laherrere (1998). "The end of cheap oil." Scientific American (March): 78-84.

Georgescu-Roegen, N. (1971). The Entropy Law and the Economic Process. Cambridge. Mass., Harvard University Press.

Hirsch, H. L., Bezdek, R., Wendling, R., (2005). Peaking of World Oil Production: Impacts, Mitigation, & Risk Management, Report to US DOE, February 2005.

Hubbert, M. K. (1949). "Energy from fossil fuels." Science 109(2823): 103-109.

Hubbert, M. K. (1956). Nuclear Energy and the Fossil Fuels. Meeting of the Southern District Division of Production, American Petroleum Institute San Antonio, Texas, Publication No. 95. Houston: Shell Development Company, Exploration and Production Research Division.

Jevons, W. S. (1865). The Coal Question; An Inquiry concerning the Progress of the Nation, and the Probable Exhaustion of our Coalmines. London, Macmillan and Co.

Meadows, D. H., D. l. Meadows, et al. (1972). The limits to growth : a report for the Club of Rome's project on the predicament of mankind. New York, Universe Books.

60. Policy Instruments for Sustainability

Economic, Regulatory and Voluntary instruments

Governments can act through different public policy instruments in order to support behavioral change towards sustainability. Instruments can vary according to the degree of public intervention: from the most intense (regulatory instruments, also referred to as 'command and control' mechanisms) to a mix of incentives and disincentives (economic instruments) and to the least intense (educative/voluntary instruments). Literature often refers to 'stick' (regulation) as a coercive mean of intervention, or 'carrot' (economic instruments) as a set of incentives/disincentives, or 'sermons' (educative/voluntary instruments) as a mean to inform society of the advantages or disadvantages of given behaviors. However, this distinction might be misleading, because on one hand economic instruments can also be used as 'stick'; on the other hand, the margin between regulatory, economic and educative instruments is blurred and in many cases the adopted policy is a result of a combination of different approaches.

Price-based economic instruments

Economic instruments are widely used in western policy-making. One of the most common categorization of economic instruments distinguishes price-based instruments and quantity-based instruments. Price-based economic instruments stand upon the concept of price signals: consumers will be oriented towards sustainable products because their price is lower than that of polluting products. We can differentiate between positive (incentives) and negative (disincentives) price-based instruments: subsidies and tax reductions (or exemptions) are positive instruments because they reduce costs of green goods; on the contrary, ecological taxation is an example of negative instrument because it affects negatively prices of polluting goods. A more practical example of positive price-based mechanisms is government subsidies to invest in renewable energy technologies (ex. solar panels) at households and at business levels. With regards to negative price-based economic instruments, the typical example is carbon tax: it applies to all forms of energy production from conventional sources (oil, coal) which are responsible for CO_2 emissions. Another example would be a "natural capital depletion tax".

Quantity-based economic instruments

The second main category of economic instruments is quantity-based mechanisms. The main principle behind quantity-based economic instruments is that governments quantify a level of allowed emissions and create an artificial market of pollution permits, based upon a price set by the scarcity of emission allowances. This mechanism makes it expensive to pollute because heavily-polluting 'participating entities' have to pay more to buy emission allowances. The system offers also incentives to reduce emissions because better performing 'participating entities' can make profits by selling exceeding emission allowances. Quantity-based mechanisms

are also known as cap-and-trade systems. This was applied in the United States to sulphur dioxide emissions, similar to proposals for carbon trade. An existing case of cap-and trade systems is the European Union Emission Trading Scheme, which applies to energy producers and energy-intensive industries at European level. Another interesting example, but rather difficult to implement, concerns the Personal Carbon Allowances: in theory, it might be possible to extend the emission market to individuals, so that people are required to buy or sell emissions according to the quantity of emissions released in their everyday life (Parag and Strickland 2009).

Other examples

Finally, there are also other policy interventions that do not adequately fit in the two above-mentioned categories. Let us take the example of public direct investments, which can also be considered to a certain extent as an economic instrument: in particular green public procurements (state buying) can be an important instrument in the pursuit of sustainability in the public sector; as well as public-private partnerships used to invest in green rail infrastructure. Other policy instruments reflect the interaction between regulatory and economic instruments: for example, environmental liability of companies generally comes from regulatory laws but companies are incentivized not to pollute in order to avoid payment of the fine (economic disincentive). On the contrary, nuclear energy firms are exempted from liability for nuclear accidents, and they are not forced to pay for the costs of long term disposal of nuclear waste. Reversal of these regulations would increase their costs. Eco-labelling is another example of combination of regulatory and economic instruments: on the basis of the well-known A to G rating for domestic appliances (regulatory instrument), governments can sponsor subsidies or tax advantages for high-efficient goods in exchange of low-efficient ones.

Negative aspects and the way forward

One of the aspects that need further analysis relates to negative consequences of any given economic instrument. Positive price-based instruments require considerable efforts from government budgets and, besides their effectiveness in the short-term, they are not economically sustainable in the long term. Negative price-based instruments, on the contrary, might entail additional production costs for companies which consequently pass costs through the final consumers. Effects of higher final prices are the loss of competitiveness for companies with activities on the international market, therefore affecting employment negatively. Quantity-based instruments may also produce negative social problems: increasing prices of basic goods (notably energy prices), unemployment, and uneven distribution of costs and benefits of the environmental policies across society.

The debate on instrument choice (regulatory, economic or voluntary) generally tends to focus on economic cost and environmental effectiveness of the policy instrument supported. Nowadays, it is recognized that voluntary agreements are the least

environmentally effective measure (as it has been the case for car industry's average fleet standards); however some educative and informative measures are still necessary to build up a general consensus about sustainability policies. For instance, fair trade rests on persuasion. Neo-liberal economists consider regulatory instruments too invasive regarding market freedom; nevertheless very strong regulation is socially well accepted in cases like the prohibition of asbestos, of tobacco smoking in public places, and in other instances. Generally, economic instruments are assumed as the most cost-effective measures to reduce negative externalities at the least cost; nonetheless market-based instruments can exacerbate social inequalities. Current and future policy instruments fostering sustainability should look at balances between different policy instruments, including compensation measures for vulnerable groups.

References:

Bemelmans-Videc M.-L., Rist R. C., Vedung, E. (1998), *Carrots, Sticks & Sermons: Policy instruments and their evaluation*, Transaction Publisher, New Brunswick (USA) and London (UK).

Driesen D. (2006), *Economic instruments for sustainable development,* in B. J. Richardson and S. Wood, *Environmental law for sustainability*, Hart publishing, pp. 343-380.

Greenspan Bell R. (2003), *Choosing Environmental Policy Instruments in the Real World*, OECD Headquarters, Paris, 17-18 March 2003.

Panayotou T. (1994), *Economic Instruments for environmental management and sustainable development*, United Nations Environment Programme (UNEP), Environment and Economics Unit.

Parag Y. and Strickland D., Personal Carbon Budgeting: what people need to know, learn and have in order to manage and live within a Carbon Budget, and the policies that could support them?, June 2009, UKERC.

61. Policy Instruments for Sustainable Tourism

Typology

Policy instruments for more sustainable tourism management are not different in essence from instruments in other fields of environmental public policy. They can be classified into economic (or market based), regulatory (or command and control) and institutional instruments. Economic instruments comprise environmental taxes, user fees, financial incentives and tradable market permits, regulatory instruments include quotas and zoning, while institutional instruments refer to eco-labels and changes in

property rights. Sometimes a combination of various policy instruments might be more effective than implementing a single one.

Tourist environmental tax

This tax is levied on tourists for environmental purposes. Debates on the consequences of levying a tax in tourism usually focus on the effects on the number of tourists due to higher prices. Whether or not a drop in tourism income will result depends mainly on the amount of tax being levied and the ability of a destination to compensate for higher prices with a higher quality of tourism products and services. Different levels of environmental tax in high and low tourist seasons can enable more equal distribution of the number of tourists during the year, and consequently reduce pressures on the environment and increase the stability of incomes. Although there are many different ways in which tourist environmental tax can be collected, the tax bases that embrace the majority of tourists and are most frequently used in practice are either tourist arrival or departure, or number of nights spent at a destination.

User fees

When access to a specific environmental resource can be controlled, charging user fees to tourists provides a simple mechanism to capture part of the benefits they derive from the use of the resource. The most common applications of this instrument in tourism are entrance fees to protection areas, as in Croatia's Lastovo Islands Nature Park or in Djerdap National Park in Serbia, both of which feature as case studies in CEECEC.

Financial incentives

These can be designed to change behaviour either by increasing or reducing the prices of particular goods or services. There are many ways in which financial incentives for reducing negative tourism impacts might be applied. Governments can encourage introducing the use of environmentally friendly equipment for water and energy-saving at hotels by lowering taxes, providing subsidies or reducing import tariffs. In a similar manner, taxes or tariffs on non-environmental goods or services could be raised. Incentives in the form of taxes on construction activities, taxes on second homes and higher building permit costs might be useful for reducing construction activities that frequently coincide with tourism development.

Eco labels

These can be applied to almost any product or service offered to tourists that satisfy certain environmental criteria (accommodation facilities, tour operators, beaches, restaurants, marinas, or tourist destinations). Because of the major growth in the number of eco labels over the last 15 years, many of them are not known to the wider public and tourists are confused. To be meaningful, an eco label must be internationally recognized and administrated by a reputable organization. The "Blue Flag" is probably the best-known international eco label in tourism, which has been awarded to beaches and marinas in 36 countries worldwide. Green Globe 21 is also

a certification for sustainable travel and tourism products and services, used principally in Asia, the Caribbean and Australia.

Quotas

Setting a limit on the number of visitors admitted to a destination during a determined period of time may include closure of certain places, like environmentally fragile areas at certain times; establishing a maximum number of accommodation units; determining a maximum number of persons allowed at certain tourist attraction, particular area or a whole country. These instruments prevent overcrowding and consequently natural resource degradation. Bhutan is the only country that has introduced a tourist quota at the national level. Its quota allows 6000 foreign tourists and 3000 tourists from neighbouring countries per year, with established fixed minimum daily expenditures per tourist. These controls are exercised through visa procedures and arrangements with tour operators. However, in the EU the right to free mobility of people represents an obstacle for implementing this measure.

Zoning

Zoning regulation can be a very effective instrument for limiting construction activities, which is one of the biggest problems related to environmental degradation caused by tourism development. This instrument allows for planned tourism development and is relatively inexpensive and easy to implement. The Physical Plan is usually the basic implementing document. It can restrict construction in environmentally sensitive areas (e.g. 100 meters from the coast) or minimize areas allocated for new construction. It usually also determines development standards, like building density and height limits, which control many aspects of the layout and design of tourist facilities. In the Maldives, for example, regulations state that the built environment should utilize no more than 20% of the total land area in order to maintain the natural beauty of an island environment. Moreover, two-storey buildings are allowed only if there is enough vegetation to screen them from view. Another example is Djerdap National Park, which has three different protection zones. Ecological economic zoning has also been proposed in another context (climate change policy) to protect Brazilian rainforests under the REDD (Reduced Emissions from Deforestation and Forest Degradation) initiative, the focus of another CEECEC case study.

In the context of tourism, tradable market permits could be applied under a zoning scheme for example, to prevent excessive construction due to tourism development. Authorities can set a maximum allowable construction quota, measured in cubic meters of built space or number of rooms per year in each area or zone, consistent with their objectives to limit further urbanization. Building permits could be allocated according to some equitable and widely accepted rules and then traded on the market. Establishing a construction limit would also limit tourist accommodation, diminishing pressures of tourism on the environment. This is not different in principle from trading in fishing quotas or cap-and-trade systems for sulphur dioxide or carbon dioxide emissions.

Change in property rights

State ownership of natural resources, land, protected areas and national parks often results in infrastructure under-investment, excessive resource depletion and environmental degradation. Private or community ownership can prove to be more successful, both in financial and environmental terms. In the case of Croatia, many tourism problems stem from state-owned hotels, inherited from the communist regime. Since the state has no funds for needed investment in these facilities, they are now considerably degraded. Consequently, they attract guests with lower purchasing power, which then affects all tourism-related businesses. Hotel privatization processes completed in Croatia over the last 15 years confirm the positive effects of the instrument, as hotels that were privatized have been refurbished and now operate rather successfully. A change in beach property rights might improve their quality further as experience with concessions suggests. This policy instrument is therefore holds particularly potential for facilitating a higher quality of specific tourism products.

References

European Environmental Agency (2006). *Using the market for cost-effective environmental policy*. EEA report 1/2006. http://www.eea.europa.eu/publications/eea_report_2006_1

Panayotou, T. (1994). *Economic instruments for environmental management and sustainable development*. UNEP/EEU: Environmental Economics Series PaperNo 16. http://conservationfinance.org/Documents/CF_related_papers/panyouto_econ_instru.pdf

62. Political Ecology

Description of the field

Political ecology analyses social forms and human organisation that interact with the environment. This burgeoning field has attracted scholars from the fields of anthropology, forestry, development studies, environmental sociology, environmental history, and geography. Its practitioners all query the relationship between economics, politics, and nature. Notwithstanding their varied background, these researchers advocate fundamental changes in the management of nature and the rights of people. A review of the term political ecology shows important differences in emphasis. Some definitions stress political economy while others point to more formal political institutions; some identify environmental change as most important, while others emphasise narratives or stories about that change.

Political ecology is at the confluence between ecologically rooted social science and the principles of political economy. It explicitly aims to represent an alternative to “apolitical” ecology. The field synthesizes the central questions asked by the social sciences about the relations between human society and its bio-cultural-political complexity, and a significantly humanised nature. Political ecology thus emcompasses the issues of the clash of individual interests and the potential for collusion that lie at the heart of political economy, and ecology’s concerns with our biological and physical environment and emphases on holistic analysis that connects with the more social and power-centred field of political economy.

Origins

The program or movement now being called political ecology appears to have emerged in reaction to certain features of human ecology or ecological anthropology as it was practiced in the 1960s and early 1970s. In particular, there was a reaction to the neglect of the political dimensions of human/environment interactions. The term "political ecology" was coined in French (ecologie politique) by Bertrand de Jouvenel in 1957, and in English by anthropologist Eric R. Wolf in 1972. The origins of the field in the 1970s and 1980s were a result of the development of radical developments in geography and cultural ecology. Historically, political ecology has focused on phenomena in and affecting the developing world. The questions of conservation and wilderness are also central to research. Conservation is indeed a human process that defines what nature is.

Underlying assumptions

More recently, political ecology has realised links with gender studies and social movement analyses. The broad scope and interdisciplinary nature of the field lends itself to several definitions and understandings. However, common assumptions across the field give it relevance. Raymond L. Bryant and Sinéad Bailey have developed three fundamental assumptions in practicing political ecology:

- First, costs and benefits associated with environmental change are distributed unequally. Changes in the environment do not affect society in a homogenous way: political, social, and economic differences account for uneven distribution of costs and benefits. Political power plays an important role in such inequalities.

- Second, this unequal environmental distribution inevitably reinforces or reduces existing social and economic inequalities. In this assumption, political ecology runs into political economies as “any change in environmental conditions must affect the political and economic status quo.” (Bryant and Bailey 1997)

- Third, the unequal distribution of costs and benefits and the reinforcing or reducing of pre-existing inequalities hold political implications in terms of the altered power relationships that are produced.

Application
Political ecology attempts to provide critiques as well as alternatives in the interplay of the environment and political, economic and social factors. Robbins (2005) asserts that the discipline has a "normative understanding that there are very likely better, less coercive, less exploitative, and more sustainable ways of doing things".

From these assumptions, political ecology can be used to:

- inform policymakers and organizations of the complexities surrounding environment and development, thereby contributing to better environmental governance.
- understand the decisions that communities make about the natural environment in the context of their political environment, economic pressure, and societal regulations
- look at how unequal relations in and among societies affect the natural environment, especially in context of government policy

References

Bryant, Raymond L. and Sinead Bailey. 1997.Third World Political Ecology. Routledge, London.

Robbins, P., 2004. Political Ecology. Blackwell Publishers, Oxford.

63. Polluter Pays Principle

Definition and origin
The polluter pays principle is an environmental policy principle which requires that the costs of pollution be borne by those who cause it. The polluter pays principle is normally implemented through two different policy approaches: command-and-control and market-based. Command-and-control approaches include performance and technology standards, such as environmental regulations in the production of a given polluting technology. Market-based instruments include pollution or eco-taxes, tradable pollution permits and product labelling.

The idea that taxation can be used to correct or internalize externalities was first introduced by A.C. Pigou in 1920 and has been generally accepted by economists as an efficient means to remedy inefficiencies in the allocation of resources, but it is understood that other social considerations such as equity, rights, political considerations and enforcement costs may tip the balance toward a preference for other policy instruments despite being less cost-effective. Pigou suggested that abatement should be pursued up to the point where the marginal cost of further abatement (reflected in the emissions fee) is just equal to the marginal benefit from reducing pollution. This "optimal pollution" tax is widely referred to as the "Pigouvian rate."

Application

Most of the time the polluter pays principle takes the form of a tax collected by government and levied per unit of pollution emitted into the air or water. As a policy instrument for the control of pollution, a tax on emissions will theoretically reduce pollution because firms or individuals will reduce emissions in order to avoid paying the tax. Under a range of market conditions, standard economists assume that pollution tax will generally be more cost-effective at reducing pollution than regulations: the total abatement cost of achieving a specified level of pollution reduction will generally be lower under a pollution tax than for a command-and-control approach that achieves the same reduction in pollution.

The polluter pays principle has received support from most countries of the Organisation for Economic Co-operation and Development (OECD) and from the European Community (EC). In international environmental law, it is mentioned in Principle 16 of the 1992 Rio Declaration on Environment and Development. At the international level the Kyoto Protocol is another tentative example of the polluter pays principle: parties that have obligations to reduce their greenhouse gas emissions must theoretically bear the costs of reducing (prevention and control) such polluting emissions. However, we know that an excessive amount of carbon dioxide has been produced by burning fossil fuels for many decades, and the polluters have not paid anything, hence, the Ecological Debt (or Carbon Debt, or Climate Debt) owed by the industrial countries. The rest of the world is (as Ecuador´s Foreign Minister Fander Falconí put it in Copenhagen in December 2009) as “passive smokers”, suffering the consequences without any compensation. Similarly, there is not the slightest intention internationally of forcing to pay for other very large externalities, such as biodiversity extinction.

Despite the fact that the polluter pays principle was publicized by early conservationists as a means to reduce ecological pollution or in general ecological damages, many observers still consider it a “vague concept”. However, the Exxon Valdez case would be an example of its application. In 1989, the oil tanker ran aground and over 300,000 barrels of crude oil poured into Alaskan waters. Exxon was in principle required to pay $125 million in fines to the federal government and the state of Alaska, as well as $900 million for a fund to be doled out by government officials for environmental projects, among other things. In addition, Exxon was put under tremendous political pressure to restore the shoreline. It thus engaged in an extensive and costly cleanup operation, with controversial results.

Concerns

Most of the sophisticated theoretical developments of the polluter pays principle that have been carried out in the neoclassical economics literature have relied on strong assumptions about the workings of the economy including competitive markets, profit-maximizing firms, rational consumers, and, in mathematical terms, “well-behaved” preferences and technologies for production. Thus, it should be remembered that relaxing one of these assumptions can alter the conclusions

reached and thus that results must always be evaluated and interpreted with great care. Moreover, an “optimal level” of pollution is often meaningless from an ecological point of view. It is indeed usually difficult for ecologists to establish a clear pollution threshold not to be exeeded. Most of the time, such objectives end up being the realm of uncertainty, where another policy principle may prevail, the precautionary principle!

Many local small and medium-sized firms cannot internalize environmental costs in their products or finance cleaner technologies, and governments often lack the power to force (e.g. extractive) industries to internalize environmental costs. In sum however, ecotaxes usually fit well into the ecological economics framework. Environmental taxes are tools for achieving two different kinds of government goals: the provision of public services and goods, and the protection of environmental quality. The joint pursuit of both goals using taxation can thus enable government to justify doing more of both.

References

Jaeger, W.K., 2003. Environmental taxation and the double dividend. International Society for Ecological Economics Internet Encyclopaedia of Ecological Economics.

Pigou, A.C., 1920. The Economics of Welfare. London. (4th edition 1932).

64. Popular Epidemiology

Definition

Popular Epidemiology is the process by which laypersons gather scientific data and information and enlist the aid of experts to understand disease. Epidemiology is "the study of the distribution of a disease or a physiological condition in human populations and of the factors that influence this distribution." Popular epidemiology therefore is when the lay public does work that is traditionally done by corporations, experts, and officials. This can involve citizen-propelled investigations of naturally occurring diseases for which no firm is responsible. However, popular epidemiology is usually employed when the issue is environmental pollution or occupational disease. In some cases, the persons and organizations responsible may have knowledge about the dangers to the public health, but do not act due to vested interests. The process of popular epidemiological investigation is therefore one of activism, in which epidemiological findings are immediately employed to understand the causes of community health problems and alleviate suffering or also to ask for compensation for liability. For instance, have cancer related deaths due to pollution (see the CEECEC UMICORE case) escaped the official medical surveys? How to count the cases of illness caused by Chevron-Texaco practices in the Amazon of Ecuador between 1970 and 1990 in areas without doctors? (San Sebastian and Hurtig, 2005). Environmental health activists are by definition acting to correct

problems that are not addressed by established corporate, political, and scientific communities.

Science and uncertainty

The cases of "popular epidemiology" that arose in the Environmental Justice movement in the United States, and similar cases elsewhere, teach several important lessons regarding the relationship between scientific rigour, human health and the assessment of uncertainty. Firstly they show the value of popular epidemiology in the detection of environmental risks. This is because people have access to data about themselves and their environment that is not available to scientists (disappearance of animals, health problems, bad odours). Citizens who feel they may be at risk may also react more quickly than authorities and their involvement makes studies possible that would not otherwise be due to lack of money and personnel. For example, some methods of lay detection can be as simple as setting up a hotline to report health problems, while government studies need time to mobilize financial resources.

Epidemiology carried out by affected communities and scientists may also differ regarding the burden of proof and the direction of proof. For example, in science we may consider 2 types of errors:

•Type 1 error: (not finding a relationship when it exists)

•Type 2 error: (finding a relationship when it doesn't exist)

For a scientist a Type 2 error is more damaging to his reputation. However, when investigating whether toxic chemicals harm the environment, privileging Type 1 errors over Type 2 errors is at odds with the public health concerns of communities. A community is therefore more likely to apply the precautionary principle, opting to err towards proof that there is no harm rather than waiting to prove harm without a doubt.

Science and values

Finally, popular epidemiology raises the issue of value neutrality in science. In cases of responsibility for environmental health there is often a trade-off between economic growth and the health of the community or the environment. Government or corporate scientists may not necessarily value these two variables in the same way as the affected community. Furthermore, while science claims to be value neutral and objective, studies in the field cannot be compared to studies in a laboratory. In real life situations, health impacts can easily be attributed to other factors, such as lifestyle choices, such as smoking. Corporate and government actors will thus magnify the inherent uncertainties in proving "sound science" in an effort to avoid liability.

The corollary of popular epidemiology is the precautionary principle, which aims to shift the burden of proof from exposed communities onto producers and distributors

of toxic waste and to implicitly prioritzes democratic over private interests in an attempt to pre-empt harm to the environment and humans. Until this is put into practice, popular epidemiology remains a valuable tool for communities dealing with risks to their health and environment.

References:

Brown, Phil. 1987. "Popular Epidemiology: Community Response to Toxic Waste-Induced Disease in Woburn, Massachusetts."Science, Technology, & Human Values, Vol. 12, No. ¾, pp. 78-85. Sage Publications.

Gibbs L. 1982. *Love Canal: My Story*. Albany: Univ. N.Y. Press

San Sebastian, Miguel, Hurtig, Anna Karin. 2005. Oil development and health in the Amazon basin of Ecuador: the popular epidemiology process. *Social science & medicine*, vol. 60, n°4, pp. 799-807.

65. Post-Normal Science

Introduction and definition

Post-Normal Science (PNS) is a problem-solving framework developed by Silvio Funtowicz and Jerome Ravetz according to which a new conception of the management of complex science-related issues is proposed. The PNS framework was introduced at the inaugural conference of the International Society for Ecological Economics in 1990.

In "normal" science, uncertainty, value loadings and plural legitimate perspectives tend to be neglected, whereas according to the "post-normal" view, these are integral elements to science. Difficult policy decisions are often needed in cases where the only existing inputs are subjective value-judgments, as opposed to the traditional "hard" and objective facts presented by traditional sciences. Hence, in the cases where facts are uncertain, values are in dispute, the stakes are high and decisions are urgent, a PNS strategy is advocated. Complementarily, when uncertainties and stakes are lower, an expert-based approach and traditional problem-solving strategies, such as applied science or professional consultancy, may be effective (**Figure 1**).

PNS recognizes that the current challenges faced by science-related policy are not characterized by regular, simple and certain phenomena. For example, in relation to many environmental, health or sustainability issues, the answers provided by "normal" science are necessary but not sufficient. The CEECEC case study by A Sud on the waste conflict in Campania, Italy for example, is presented as a as a Post Normal Science problem. Within this context, PNS provides a coherent framework for an extended participation in decision-making, whereby the quality assurance of

policies relies on open dialogues between all those affected (i.e. what Funtowicz and Ravetz call “extended peer communities”).

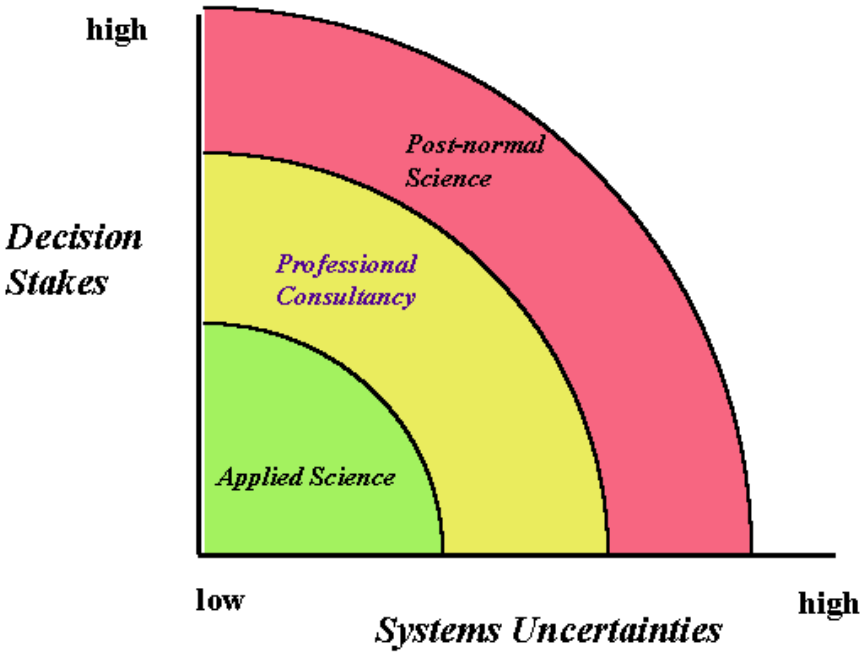


Figure 1: Post-Normal Science diagram
(Source: Funtowicz and Ravetz 2008)

Elements and principles of Post-Normal Science

The main elements and principles of PNS include (Funtowicz and Ravetz, 1990; Funtowicz and Ravetz, 1994):

1. The scientific management of uncertainty and of quality

In the issue-driven research of PNS, the characteristic uncertainties are large, complex and less well understood than in matured quantitative sciences. Hence, the management of uncertainties should rely on explicit guidelines and credible set of procedures such as those provided in the NUSAP notational system. The NUSAP categories stand for “Numeral”, “Unit”, “Spread”, “Assessment” and “Pedigree”, enabling the different sorts of uncertainty in quantitative information to be expressed in a standardized way and presented transparently to all the actors involved in a policy process.

The principle of quality, understood as a contextual property of scientific information, is central to the management of uncertainty in PNS. It allows tackling the irreducible uncertainty and ethical complexity that are central to the resolution of complex issues. Consequently, PNS calls for the development of new norms of evidence and discourse, where knowledge is extended to peer communities for quality assurance

purposes. Thus, one of the basic principles of PNS is the inclusion of laypersons, such as citizens and other non-experts in the assessment of quality. PNS recognizes that all those with a desire and commitment to participate in the resolution of the relevant issues are expected to enrich the nature of policy debates involving science.

2. The multiplicity of perspectives and commitments

As policy processes become dialogue, knowledge is "democratized," encompassing the diversity of legitimate perspectives and commitments. Again, the guiding principle in the dialogue on a PNS issue is quality rather than "truth". Most complex issues entail a plurality of actors and multiple dimensions of analysis that are difficult to condense in a single scale of measurement. It is accepted that there is no sharp distinction between "expert" and "lay" constituencies. As a consequence, both types are needed to enrich the comprehension of the whole. Extending decision processes requires the creation of conditions to identify, involve and engage the relevant community, thus entering the realm of participatory processes. The contribution of social actors is understood not merely as a matter of broadening participatory democracy, but as a legitimate input to the co-production of knowledge. These extended peer communities are increasingly being created, with different forms and power arrangements, such as "citizens' juries", "focus groups" or "consensus conferences";

3. The intellectual and social structures that reflect problem-solving activities

Unlike previous models of science, PNS does not attempt to define unifying conceptual foundations or to create closed boundaries in a field of research. Hence, the unity in PNS is primarily derived from an ethical commitment to the resolution of an issue rather than from a shared knowledge base. This commitment will take social actors through the appropriate problem-solving activities and dialogues. In this fluid context, quality assurance processes maintain the integrity of the intellectual structures that inform research, supported by the appropriate institutional structures or arrangements.

An extended tutorial on PNS ("Environmental Policy under Conditions of Complexity"), case study reports and additional supporting materials are available from www.nusap.net.

References

Funtowicz, S., Ravetz, J. 1990. *Uncertainty and Quality in Science for Policy*. Kluwer Academic Publishers, the Netherlands.

Funtowicz, S., Ravetz, J. 1993. Science for the post-normal age, *Futures* 25 (7), 739–755.

Funtowicz, S., Ravetz, J. 1994. The Worth of a Songbird: Ecological Economics as a Post-normal Science, *Ecological Economics*, 10(3):197-207.

Funtowicz, S., Ravetz, J. (Lead Authors); International Society for Ecological Economics (Content Partner); Robert Costanza (Topic Editor). 2008. "Post-Normal Science." In: Encyclopedia of Earth. Eds. Cutler J. Cleveland (Washington, D.C.: Environmental Information Coalition, National Council for Science and the Environment). [First published in the Encyclopedia of Earth September 18, 2006; Last revised December 22, 2008; Retrieved January 8, 2010]. <http://www.eoearth.org/article/Post-Normal_Science>

Websites:

www.nusap.net

alba.jrc.it/main.html

postnormaltimes.net/blog

66. Precautionary Principle

Concept

Human life is full of risks which we have to deal with. Science and technology can help in diminishing some risks of nature, as it is the case for example with life expectancy. On the other hand, science and technology have also contributed to the creation of new threats to human existence or quality of life. The emergence of increasingly unpredictable, uncertain, and unquantifiable but possibly catastrophic risks has confronted societies with the need to develop an anticipatory model in order to protect humans and the environment against these uncertain risks of human action: the precautionary principle.

Origins

The precautionary principle traces its origins to the early 1970s in the German principle *Vorsorge*, or foresight, based on the belief that the society should seek to avoid environmental damage by careful forward planning. The *Vorsorgeprinzip* has been developed into a fundamental principle of German environmental law and was invoked to justify the implementation of robust policies to tackle acid rain, global warming, and North Sea pollution. The precautionary principle then flourished in international statements of policy. The principle was introduced in 1984 at the First International Conference on Protection of the North Sea. Following this conference, it was integrated into numerous international conventions and agreements (Bergen declaration on sustainable development, Maastricht Treaty of the European Union,

etc.). On a national level, several countries have made the precautionary principle guides to their environmental and public health policy. In the United States, the precautionary principle is not expressly mentioned in laws or policies. However, some laws have a precautionary nature, and the principle underpins much of the early environmental legislation in this country (The National Environmental Policy Act, The Clean Water Act, The Endangered Species Act).

Definitions

The precautionary principle is based on the adage that “it is better to be safe than sorry”. However, there is no universally accepted definition of the principle. Despite the fact that the precautionary principle has formulated in many different ways in many different places, the definition in the Rio Declaration is the one most often referred to:

In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation. (Rio Declaration 1992, Principle 15).

This definition is rather weak, calling for the *consideration* of precautionary intervention rather than requiring such intervention. A stronger definition can be found in an EU communication that demands intervention to maintain the high level of protection required by the EU. It states that:

The precautionary principle applies where scientific evidence is insufficient, inconclusive or uncertain and preliminary scientific evaluation indicates that there are reasonable grounds for concern that the potentially dangerous effects on the environment, human, animal or plant health may be inconsistent with the high level of protection chosen by the EU (EU, 2000).

Despite the lack of consensus on definition, each formulation of the precautionary principle shares the common prescription that scientific certainty is not required before taking preventive measures. Moreover, most versions involve some degree of burden shifting to the promoter of an activity or product. Finally, all the definitions lack to answer the question of the amount of precaution to apply in a given circumstance.

Relevance

The precautionary principle is relevant to many issues, especially those of environment and public health; global warming or sharp climate change, extinction of species, introduction of new and potentially harmful products into the environment that threaten biodiversity (e.g. genetically modified organisms), threats to public health due to new diseases or techniques (e.g. AIDS transmitted through blood transfusion), persistent or acute pollution (asbestos, endocrine disruptors, etc.), food

safety (e.g. Creutzfeldt-Jakob disease), and other new bio-safety issues (e.g. artificial life, new molecules).

Controversy and critiques

Besides its apparent simplicity, the principle has given rise to a great deal of controversy and criticisms.

- The precautionary principle is said to not be based on sound science. In this sense, critics claim that decision-makers are sometimes selective in their use of the precautionary principle, applying it for political reasons, rather than scientific reasons.

- When applying the principle, society should establish a threshold of plausibility or scientific certainty before undertaking precautions. Indeed, no minimum threshold is specified across the definitions so that any indication of potential harm could be sufficient to invoke the principle. Most times, a ban on the product or activity is the only precaution taken.

- Another often raised criticism points to the potentially negative consequences of its application; for instance, a technology which brings advantages may be banned because of its potential for negative impacts, leaving the positive benefits unrealized.

- Some say that the precautionary principle is impractical since every implementation of a new technology carries some risk of negative consequence.

The debate on the precautionary principle indicates its growing prominence in policy-making about risks to human health and the environment.

References:

EU (2000), *Communication from the commission on the precautionary principle* COM1, Brussels: Commission of the European Communities.

M. Hanson, The precautionary principle, in E.A. Page & J. Proops, Environmental Thought, Cheltenham (UK), Edward Elgar, 2003, pp. 125-143.

J. Paterson (2007), Sustainable development, sustainable decision and the precautionary principle, *Nat Hazards*, 42:515-528.

Rio Declaration (1992), Report of the United Nations Conferences on Environment and Development, Rio de Janeiro, 3-14 June1992, Annex I, Rio Declaration on Environment and Development. (http://www.un.org/documents/ga/conf151/aconf15126-1annex1.htm).

67. Property Rights

The standard economic definition

In standard economics, property rights refer to a bundle of entitlements defining an owner's rights, privileges, and limitations to the use of a resource. An efficient structure of property rights is said to have three characteristics: *exclusivity* (all the costs and benefits from owning a resource should accrue to the owner), *transferability* (all property rights should be transferable from one owner to another in a voluntary exchange) and *enforceability* (property rights should be secure from seizure or encroachment by others). Conventional economic theory assumes that a resource owner with these three characteristics has a significant incentive to use that resource efficiently because a loss of value of this resource represents a personal loss. Also, clearly defining and assigning property rights should resolve environmental problems by internalizing externalities and relying on incentives for private owners to conserve resources for the future. However, this assumes that it is possible to internalize all environmental costs, that owners will have perfect information, that scale economies are manageable, transaction costs are bearable, and that legal frameworks operate efficiently. Strengthening markets and creating and strengthening property rights should – so the story goes – reduce such problems. We know that private owners discount the future, they value present revenue over future private and social benefits when they operate in a market system.

The different categories of property rights

Property rights come in many forms (Ostrom, 1990; Bromley, 1991; Heinsohn and Steiger, 2003), encompassing a few basic categories:

- Private property rights are held by individuals and firms and can be transferred between them, most of the time through the exchange of money. Private property rights are the basis for markets to the point that markets cannot exist without them.

- In state-property regimes, governments own and control property. This type of regime exists to varying degrees in all countries of the world. For example, parks and forests are frequently owned and preserved by governments. In communist countries, governments may own all resources. Problems can occur with state-property rights when the incentives of rule-makers for resource use diverge from the collective interest. For example, toxic and radioactive waste had accumulated in Russia by the year 2990 because central plans which established national priorities favoured growth over environmental protection.

- Common-property regimes refer to properties jointly owned and used by a specified group of co-owners through formal (specific legal rules) or informal (protected by tradition or custom) entitlements. While there are numerous very successful examples of common-property regimes such as Swiss alpine common property regimes, unsuccessful examples exist also. Population pressure and

increased demand from outsiders undermines collective cohesion to the point where traditional rules became unenforceable leading to overexploitation of the resource and lower incomes for all.

- Open access regimes can be exploited on a first-come, first-served basis because no individual or group has the legal power to restrict access. The consequences of open access have become popularly known as what Hardin (1968) misleadingly called "the tragedy of the commons".

The transition to a Western-type property system

The transition to capitalism has historically been preceded by land appropriation by large private landowners or by the state, through different kinds of "enclosure movements" – physical as well as legal. The English version of this process was defined by Polanyi (1944) as a "revolution of the rich". During the 19th and 20th centuries, former colonial administrations introduced Western-type property rights in order to secure their access to natural resources. They often transformed customary common pool resources – such as forests – into state property. This phenomenon led to an unequal repartition of property rights allowing capitalist accumulation through the dispossession of community customary rights. A Western-type property regime is indeed central in the functioning of capitalism itself by standardizing the economic system, by fixing the economic potential of resources in order to allow credit and selling contracts, and by protecting (by armed force if needed) property and transactions (Heinsohn and Steiger, 2003).

Today, the approach of standard economics still emphasizes the necessity to extend a Western-type property system to all kind of goods and services in order to ensure growth and even "sustainability". Surprisingly, such policy is still frequently referring to Hardin's (1968) "tragedy of the commons", based on the erroneous conflation of open access and commons. The important point is to achieve a correct match between institutions, and cultural and biophysical environments. Indeed, anthropological studies have shown that societies have often developed institutions regulating access rights to natural resources and duties between different community members in order to ensure the social functioning of the group and the management of natural resources (Berkes, 1999). Thus, the transformation of common pool resources into state and private property has often been socially unequal and ecologically unsustainable.

References

Berkes, F. 1999. *Sacred ecology: traditional ecological knowledge and resource management*. Philadelphia: Taylor and Francis.

Bromley, D. (ed.). 1992. *Making the commons work*. San Francisco: The ICS Press.

Hardin G. 1968. The tragedy of the commons. *Science*, 162, 1243–1248.

Heinsohn, G. and Steiger, O. 2003. The property theory of interest and money. In: *Recent developments in institutional economics* (Ed. Hodgson, G. M.), pp. 484–517. Cheltenham: Edward Elgar.

Ostrom, E. 1990. *Governing the commons: the evolution of institutions for collective action*. Cambridge: Cambridge University Press.

Polanyi, K. 1944. *The great transformation*. Boston: Beacon Press.

Websites:

http://www.eoearth.org/

http://www.ecoeco.org/education_encyclopedia.php

68. Rebound Effect (Jevons' Paradox)

Introduction

A central concept in industrial ecology, the term Jevons' Paradox was derived from a passage in W. S. Jevons, *The Coal Question*, 1865, in which the author analyzes improvements in the efficiency of the steam engines over the last decades. The first steam engines powered by coal had very low efficiency, of the order of 5%. They produced a lot of noise and a lot of dissipated heat, and only a little bit of effective work in spinning or weaving machines, or moving the first trains. With time efficiency improved, and Jevons posited that this increased efficiency would not necessarily lead to a decrease in demand for coal by manufacturers and railway companies. On the contrary, increased efficiency in fact led to a decrease in the actual cost of coal per unit of work done. It could lead therefore to an increase in the demand for coal. This was later called the "Rebound Effect".

Application

For instance, consider an increase in the efficiency of transport by motor car of 20 percent. This means that a similar car now can travel 20 percent more miles that the previous model, with the same amount of petrol. What will car buyers do? They might decide to travel the same amount of miles as before, saving petrol, or they might decide (depending on the price-elasticity of demand) to travel more miles (or to buy bigger cars), therefore not saving petrol to to the same extent or not saving petrol at all. As another example, assume that you change your electric light bulbs to longer lasting energy saving bulbs. You have paid some initial amount of money to buy the new bulbs but per month you are now spending less KWh and therefore less money, for the same amount of lighting. What are you going to do with the money you are saving? First you pay back the initial investment. Once this is done, it is unlikely that you are going to put more light bulbs around the house. But it is not unlikely that this extra money will now go at least in part to extra tavel or extra consumption, entailing some extra amounts of energy expenditure.

A point of caution

When we see that increased efficiency in the use of energy (or materials) is coupled with increased use, we cannot directly conclude that the Jevons' Paradox or the Rebound Effect is at play. It may be that increased efficiency is leading, hopefully, to less use of energy (or materials), but nevetherless this can be nullified by a simultaneous increase in incomes due to economic growth, ultimately resulting in increased use of energy (or materials). Here we must pay attention not to the price-elasticity of demand but to the income-elasticity of demand. In fact, the main cause of the increased social metabolism of the economy is economic growth. It is not Jevons' Paradox or the Rebound Effect.

Reference

John M. Polimeni, Kozo Mayumi, Mario Giampietro, Blake Alcott: The myth of resource efficiency: The Jevons Paradox, Earthscan, London, 2008, 184 p.

69. Resilience

Definition

Resilience may be defined as the capacity of a system to absorb disturbance and reorganize while undergoing change, so as to still retain essentially the same function, structure, identity and feedbacks. In ecological systems, resilience is a measure of how much disturbance an ecosystem can handle without shifting into a qualitatively different state. It is the capacity of a system to both withstand shocks and surprises and to rebuild itself if damaged. There are several examples of ecological systems that have undergone dramatic changes in structure and function as a response to external stresses, such as the shift of a freshwater system from a state of clear water, benthic vegetation, oligotrophic macrophytes and abundant fish to a eutrophic state characterized by turbid water, blue-green algae and where fish is absent. Another documented example is the case of marine systems changing from a state dominated by coral reefs, kelp forests and rich biodiversity to a state dominated by algae and urchins and depleted fish stocks. Many ecologists no longer focus on the "carrying capacity" of given territories (with their assumed smooth Verhulst's curves indicating maximum populations of species that one territory could carry) but rather focus on the resilience of ecosystems.

Social resilience is the ability of human communities to withstand and recover from stresses, such as environmental change or social, economic or political upheaval. Resilience in societies and their life-supporting ecosystems is crucial in maintaining options for future human development. Resilience, for social-ecological systems, has three defining elements: (1) the magnitude of shock that the system can absorb and remain within a given state; (2) the degree to which the system is capable of self-organization; and (3) the degree to which the system expresses capacity for learning and adaptation. More resilient socio-ecological systems are able to absorb larger

shocks without changing in fundamental ways. When massive transformation is inevitable, resilient systems contain the components needed for renewal and reorganization (Folke, et al., 2002).

In summary, resilience is the potential of a system to remain in a particular configuration and to maintain its feedbacks and functions, and involves the ability of the system to reorganize following disturbance-driven change.

Resilience assessment and management

Management can destroy or build resilience. Managing for resilience enhances the likelihood of sustaining development in a changing world where surprise is likely. The focus is on maintaining the capacity of the system to cope with whatever the future brings, without the system changing in undesirable ways.

The two aims of resilience management are: (1) to prevent the system from moving to undesired system configurations in the face of external stresses and disturbance (this can be achieved either by increasing resistance or by allowing a greater array of "safe" resource use options) and (2) to enable the system to renew and reorganize itself following a massive change. This adaptive capacity, i.e., the capacity of a system to adapt and shape change, resides in aspects of memory, creativity, innovation, flexibility, and diversity of ecological components and human capabilities.

Diversity is a key element for resilience in social-ecological systems. When the management of a resource is shared by diverse stakeholders (e.g., local resource users, research scientists, community members with traditional knowledge, government representatives), decision-making is better informed and more options exist for testing policies. Active adaptive management whereby management actions are designed as experiments encourages learning and novelty, thus increasing resilience in social-ecological systems.

Resilience assessment and management involves the following main steps:

1. **Resilience of what?** The first step of a resilience assessment involves defining the system of interest and specifying issue(s) of concern. This is accomplished by describing the key attributes of the system, based strongly in stakeholder inputs;

2. **Resilience to what?** This involves indentifying the main disturbances and processes that may influence the system, i.e. studying external disturbances and the development processes (policy drivers and stakeholder actions) to which the desirable configurations are expected to be resilient. Visioning and scenarios can be a useful tool in this stage;

3. **Resilience analysis.** This step consists of exploring the interactions of the first two items to identify possible driving variables and processes that govern the dynamics of the system, looking especially for threshold effects and other non-linearities. Modeling can be used at this stage to develop further understanding of the dynamics of the system.

4. **Resilience management.** The final step involves a stakeholder evaluation of the whole process and the implications of the emerging understanding for policy and management actions. This does not mean that the process is aimed at finding the 'right' policies that keep the system in some pre-defined optimal path, but in defining a set of rules that enhance the system's ability to reorganize and move within some configuration of acceptable states, without knowing or caring which particular path the system might follow.

The Resilience Alliance has developed a set of workbooks to support resilience assessment directed for practitioners and scientists that can be downloaded from http://www.resalliance.org/.

References

Folke, C., S. Carpenter, T. Elmqvist, L. Gunderson, CS Holling and B. Walker, 2002. Resilience and Sustainable Development: Building Adaptive Capacity in a World of Transformations, *Ambio*, Vol. 31 No. 5, August 2002, 437-440.

Holling, C. S. 1973. Resilience and stability of ecological systems. *Annual Rev Ecol Systems* 4:1-23.

Resilience Alliance, 2007. Assessing and managing resilience in social-ecological systems: A practitioners workbook. Version 1.0, June 2007.

Resilience Alliance, 2007. Assessing and managing resilience in social-ecological systems: A workbook for scientists. Version 1.0, June 2007.

Walker, B., C. S. Holling, S. R. Carpenter, and A. Kinzig. 2004. Resilience, adaptability and transformability in social–ecological systems. *Ecology and Society* 9(2): 5. [online] URL: http://www.ecologyandsociety.org/vol9/iss2/art5 .

Websites:

http://www.stockholmresilience.org/

http://www.resalliance.org/

70. Resource Intensity and Resource Productivity

Definition

Resource intensity is a measure of the resources (e.g. materials, energy, water) required for the provision of a unit of a good or service. It is usually expressed as a ratio between resource input and product or service units provided (expressed in value, mass, volume, or other unit deemed as appropriate). Resource productivity, the inverse of resource intensity, is a measure of the output (expressed either as

units produced or as economic value) per unit of resource input.

Resource productivity and resource intensity are important concepts in the sustainability debate. They are essential concepts to measure the progress of dematerialization strategies, aimed at decoupling resource input (and the corresponding environmental burdens) from economic development. Dematerialization refers to the absolute or relative reduction in the quantity of materials used and/or the quantity of waste produced in the generation of economic output. The objective for efficiency-led sustainability strategies is to promote dematerialization by maximizing resource productivity, while minimizing resource intensity.

As stated above, resource intensity is often defined in the ecological economics literature as the ratio of materials use to value added, which in the case of an economy is equivalent to gross domestic product (GDP). The following equation summarizes this definition (modified from Cleveland and Ruth, 1999):

$$IU_i = \frac{X_i}{GDP} = \left(\frac{X_i}{Y}\right) \times \left(\frac{Y}{GDP}\right)$$

where,

IU_i – resource intensity for material i

X_i – consumption of a given material *i*

Y – output of industries that consume material *i*

GDP – Gross Domestic Product, which reflects the total output of the economy

The equation shows that resource intensity is determined by two factors. The first term on the right-hand side of the equation is the material composition of product, which reflects changes in the mix of materials used to produce individual goods and services. The second term is the product composition of output, which reflects changes in the mix of goods produced by the economy.The resource intensity of an economy may change due to a number of factors, namely (Cleveland and Ruth, 1999):

- Technical improvements that decrease the quantity of materials used to produce a good or service. Examples include metal use in the beverage container industry, materials use in automobile manufacture and communications.

Substitution of new materials with more desirable properties for older materials. An example is the substitution of optical fibres for metal wire in communications.

- Changes in the structure of final demand - the mix of goods and services produced and consumed by an economy changes over time due to shifts among sectors, such as the rise of the service sector, or shifts within sectors, such as the increasing dominance of computers and other high-technology goods within the

manufacturing sector.

- The saturation of bulk markets for basic materials. This line of reasoning holds that as an economy matures, there is less demand for new infrastructure such as bridges, roads, railways, steel factories, and so on, reducing the need for steel, cement, and other basic materials.

- Government regulations that alter materials use. A prominent example is the regulation of lead additives in gasoline and other products that contributed to a sharp decline in the IU of lead.

The intensity concept can be applied to different resources/pressures such as materials input, energy consumption, greenhouse gases emissions and water use. Different indicators have been used to measure resource intensity for these areas of concern.

Indicators of resource intensity

The most widely known indicator of resource intensity is MIPS – Material Intensity Per Service unit, that was proposed by Schmidt-Bleek at the Wuppertal Institute (Schmidt-Bleek, 1994). Note that the denominator in MIPS is not the amount or value of product, but the number of service units provided. The whole lifecycle from cradle to cradle (extraction, production, use, waste/recycling) is considered. MIPS can be applied in all cases where the environmental implications of products, processes and services need to be assessed and compared. A practical application of the MIPS concept is called material intensity analysis. Material intensity analyses are conducted on the micro-level (focusing on specific products and services), as well as on the macro-level (focusing on national economies). You can go for instance to http://www.wupperinst.org/en/projects/topics_online/mips/index.html for calculation and data sheets for MIPS computation as well as a set of publications on this issue.

Energy intensity is an indicator that is often used in energy policy and climate change debates. The energy intensity of an economy is a measure of the country's energy efficiency. It is calculated as the amount of energy consumed per unit of GDP generated in the economy. This indicator is also used to measure the energy efficiency of products and services such as appliances and buildings, vehicles and transportation systems.

Water productivity is also a widespread concept, namely in the context of agricultural water use. For example FAO – the UN Food and Agriculture Organization defines *crop water productivity* as 'the amount of water required per unit of yield' (http://www.fao.org/landandwater/aglw/cropwater/cwp.stm), in reality is a measure of *crop water intensity*.

Discussion

Several critiques have been raised on the use of concepts such as resource intensity and dematerialization as guiding principles and measuring sticks for the formulation of sustainability strategies.

First of all, indicators such as MIPS or water intensity do not tell us anything about the qualitative aspects and the environmental impacts associated with the weight of material resources or volume of water used. Different materials have quite different environmental impacts and a reduction in the amount used can actually lead to higher environmental burdens if it is the result of replacing some materials by more environmentally harmful substitutes (that are for instance scarcer or more toxic). Also, when the denominator is expressed as an economic value, an observed decrease in resource intensity may be due to a reduction in the amount of materials used or to an increase in the economic value of the products.

Another important issue is the discussion around the so-called 'rebound-effect' or Jevons' Paradox, which translates as the risk of increased resource productivity enabling higher economic growth. The associated increase in the scale of the economy may lead to an overall environmental burden that may outgrow the improvements achieved by increased resource productivity.

References

Cleveland, C., M. Ruth, 1999. Indicators of Dematerialization and the Materials Intensity of Use, *Journal of Industrial Ecology*, 2, 3, 15-50.

Huber, J., 2000. Towards Industrial Ecology: Sustainable Development as a Concept of Ecological Modernization*, J. Environ. Policy Plann.*, 2: 269–285.

Schmidt-Bleek, F. 1994. Revolution in resource productivity for a sustainable economy—a new research agenda. *Fresenius Environmental Bulletin*, 2: 245–490.

71. Scenarios and Visioning

Scenarios: Definition

Prospective, forward-looking studies include a vast range of concepts and approaches, which aim at exploring plausible and/or preferable futures to improve decision-making processes. Examples of methods used in futures studies include scenario building, visioning, forecasting, cross impact analysis, simulation and modelling). Since the foundations of modern-day techniques by the Rand Corporation in the 1950s, these methods have been applied both in private organizations and in public policy domains, as a basis for strategic planning.

Scenarios are alternative images of how the future might unfold. They represent coherent and plausible stories about the co-evolutionary pathways of human and ecological systems. In other words, scenarios are internally consistent descriptions

of plausible future states of the world. Many authors maintain that scenarios are not forecasts or predictions. For ecological economics, one main virtue of scenarios is that they force the integration of findings from different disciplines.

Application

Scenarios have been increasingly used to support planning, assessment and implementation of decisions regarding environmental and sustainability issues, serving a variety of purposes:

- **Policy analysis**, providing a picture of future alternative states of human and ecological systems in the absence of additional policies ('baseline scenarios') and comparing these with the future effects of environmental policies ('policy scenarios');

- **Raising awareness** about emergent problems and about possible future interrelationships between different issues;

- **Broadening perspectives** on certain themes, accounting for larger time and spatial scales of analysis, and highlighting consequences of strategic choices in society;

- **Synthesising information** about possible futures, including both 'qualitative' (e.g. in the form of narratives/storylines, diagrams or other visual symbols) and 'quantitative' scenarios (e.g. providing information in the form of tables and graphs, usually based on the results from computer models);

- **Dealing with** uncertainty **and** complexity, by confronting decision-makers with the present lack of knowledge about system conditions and underlying dynamics, thus rendering more transparent and precautionary decision-making processes;

- **Promoting** public participation, allowing for the integration of normative dimensions of sustainability, widening the knowledge base, developing a common language and enhancing mutual learning.

An important distinction is usually made between 'exploratory' and 'anticipatory' scenarios. The former, also known as 'descriptive', begin in the present and explore trends into the future, giving way to a possible sequence of emerging events. In some studies, this approach to scenario building is referred to as 'forecasting', where the goal is to provide the most likely or probable projection of future conditions. On the other hand, anticipatory scenarios start with a prescribed vision of the future and then work backwards in time to figure out how this future could emerge. The term 'backcasting' is frequently used to describe a particular anticipatory approach wherein normative scenarios are developed backwards from a particular 'desired end-point' or set of goals.

Unlike forecasts, backcasts are not intended to reveal what the future will likely be, but to explore the feasibility and implications of different futures according to criteria of social or environmental desirability. Finally, it should be underscored that for environmental and sustainability problems, a combination of anticipatory and

exploratory approaches may be appropriate. To this extent, it is possible to identify an array of desired end-states and then test these against forward-looking analyses departing from initial conditions and drivers of change.

Some ilustrations

A typical scenario in environmental studies includes the following structural building blocks: i) the driving forces, which influence the changes in the relevant system of analysis, ii) the time horizon and time steps, and ii) narratives or storylines describing the main features of the scenarios. However, depending on the selected approach, there are many procedures for developing scenarios. For example, in the Millennium Ecosystem Assessment, which explored possible future changes in the provision of ecosystem services, the procedure for selecting the scenario building blocks started with the identification of two broad uncertainties – the connectivity of social and political organizations (global connection versus regional disaggregation) and the nature of the policies and practices implemented by these organizations (reactive versus proactive). By clustering the scenarios around these contrasting branches, four main scenario storylines were developed – 'Global Orchestration', 'Technogarden', 'Adapting Mosaic' and 'Order from Strength'.

There are many other well-known examples of scenarios developed in environmental and sustainability studies. The EEA (http://scenarios.ew.eea.europa.eu) organizes such studies according to their focus on **regions** (e.g. UNEP's Global Environmental Outlooks, Global Scenario Group's Great Transition scenario), **themes** (e.g. the WBCSD's water scenarios, IPPC's emissions scenarios, EEA's land-use scenarios for Europe - PRELUDE), and specific **sectors** (e.g. FAO's world agriculture scenarios).

Visioning: Concept and methodologies

A 'vision' for an organisation, group or community is an image of what they desire to be, and which they have the power to bring to life. The process of developing a vision – 'visioning' or 'envisioning' – is concerned with eliciting desirable futures for the purposes of assisting in strategy development and providing decision-making guidance. O'Brien and Meadows (2001) highlight the following generic stages in visioning methodologies:

1) **Analysis of the current situation and assessment of external factors**. This stage may be performed before or after the development of the vision. While some authors defend that a prior assessment grounds the vision in realism, others argue that it constrains the ability to think of 'ideal states' by focusing on current conditions and capabilities;

2) **Developing the vision**, i.e., identifying the desired future states. Visions may consist of vibrant descriptions of audacious goals, as well as reflective or instinctive statements addressing the aspired futures;

3) **Connecting the future to the present**. As indicated above, the concept of 'visions' is closely linked to a backcasting approach to the development of scenarios,

although the linkages between the vision and the current state may also be supported by forward planning methods;

4) **Testing the vision**, checking for internal feasibility and robustness given the potential external conditions.

Types of application

In order to define the contexts in which visions are claimed, used or developed, van der Helm (2009) identified seven types of visions and their basic distinguishing characteristics: 1) **Humanistic**, addressing universal betterment; 2) **Religious**, addressing worldly life in relation to the hereafter; 3) **Political**, related to ideologies and providing a sense of leadership and support; 4) **Business/organisational**, commonly expressing an organisation's ambition and leadership-driven management; 5) **Community**, consensual integration of actors and collective action; 6) **Policy support**, increasingly found in the domain of public policy making; and 7) **Personal**, developed within personal development projects.

Forstater (2004) elaborates on yet another type of vision which is regarded as central to ecological economics – the pre-analytical vision of seeing the economy in terms of metabolic flows, as a subsystem of a wider biophysical system. As argued by Meadows (1996) and Costanza (1997), a coherent and relatively detailed, shared vision of both the way the world works and of the society we wish to achieve is vital to moving towards sustainability goals. Building such a responsible vision is a supra-rational task of imagination that comes from values, not logic.

In recent years there has been a proliferation of methods combining visioning with multi-stakeholder deliberative decision-making processes, which include 'Scenario Workshops', 'Future Search Studies' and 'Community Visioning'. Kallis et al. (2009) reviewed these methods comparing their standout features, describing a visioning exercise in the context of sustainable water management in a Greek island.

References

Costanza, R., 1997. Introduction: Buidling transdiciplinary bridges at the frontiers of ecology and economics. *Frontiers in Ecological Economics*. Edward Elgar, Cheltenham, UK.

Forstater, M., 2004. Visions and scenarios: Heilbroner's worldly philosophy, Lowe's political economics, and the methodology of ecological economics. *Ecological Economics*, 51, 17-30.

Kallis, G., Hatzilacou, D., Mexa, A., Coccossis, H., Svoronou, E., 2009. Beyond the manual: Practicing deliberative visioning in a Greek island. *Ecological Economics*, 68, 979-989.

Meadows, D., 1996. Envisioning a Sustainable World, in *Getting Down to Earth, Practical Applications of Ecological Economics*, Costanza, R., Segura, O., Martinez-Alier, J. (eds.), Island Press, Washington DC.

O'Brien, F., Meadows, M., 2001. How To Develop Visions: A Literature Review, and a Revised CHOICES Approach for an Uncertain World. *Journal of Systemic Practice and Action Research*, 14 (4), 495-515.

Van den Helm, R., 2009. The vision phenomenon: Towards a theoretical underpinning of visions of the future and the process of envisioning. *Futures*, 41, 96-104.

Websites:

http://scenarios.ew.eea.europa.eu/

http://www.unep.org/GEO/

http://www.shell.com/home/content/aboutshell/our_strategy/shell_global_scenarios

http://www.millenniumassessment.org/en/Scenarios.aspx

http://www.framtidsstudier.se/eng

http://www.gsg.org/

http://www.futuresearch.net/

http://www.ncl.org/

http://cordis.europa.eu/easw/

72. Social Metabolism and Accounting Approaches

Social Metabolism: A Biophysical Approach to the Economy

In recent years a consensus seems to have grown that regards sustainability as a problem of the interaction between society and nature (Haberl et al. 2004). The precise nature of this interaction is biophysical: It is the continuous throughput of materials and energy on which each socio-economic system depends and which constitutes its relation to the natural environment. Such an understanding of society as a socially organized and thermodynamically open system has been termed *social* (Fischer-Kowalski and Haberl 1993) or *industrial metabolism.*

The application of the biological concept of metabolism ("Stoffwechsel") to social systems can be traced back to Marx who, influenced by Liebig and Moleschott, talks about the "metabolism between man and nature as mediated by the labour process". Such a biophysical approach to the economy was not unusual at the turn of the 19th century but arguably did not form an integrated school of thought until recently (see Martinez-Alier 1987; Fischer-Kowalski 2002). This biological analogy grew from the observation that biological systems (organisms, but also higher level systems such

as ecosystems) and socio-economic systems (human societies, economies, companies, households etc.) decisively depend on a continuous throughput of energy and materials in order to maintain their internal structure (Fischer-Kowalski and Haberl 1993).

Social Metabolism Accounting Methods

The social concept links material and energy flows to social organization, recognizing that the quantity of economic resource use, the material composition and the sources and sinks of the output flows are historically variable as a function of the socio-economic production and consumption system. When speaking of metabolism however, one must have adequate knowledge of the system that has to be reproduced. Only then is it possible to assess the material and energetic flows required for the maintenance of the system in question. Most likely the system is a society at a specific level of scale and might be described as an organized set comprising a cultural (symbolic) system and those material elements accorded preferential treatment by the cultural system (human population and material artefacts) (Fischer-Kowalski and Weisz 1999). The flows are accounted where society appropriates or releases materials from or to nature.

Today, *social or industrial metabolism*, along with standardized methods to account for its energy flow, material flow, and land use aspects, provides the basis for empirical analyses of the biophysical structure of economies and for developing strategies towards more sustainable production and consumption patterns. A number of operational tools have been developed to analyze the biophysical aspects of social metabolism, its associated driving forces and environmental pressures (Haas et al. 2005***)***. Examples outlined below include material and energy flow analysis (MEFA, or MFA), input-output analysis (IOA) and life cycle analysis (LCA), but other instruments in the social metabolic toolkit include HANPP, EROI, and Virtual Water, as well as related concepts such as ecological footprinting and ecological rucksacks.

72.1 Material Flow Analysis (MFA)

Material flow accounting (MFA) is a specific environmental accounting approach, aiming at the quantification of social metabolism. MFA is applicable to various geographic and institutional scales. MFA at the national level (denoted as economy-wide MFA) is probably most advanced in terms of methodological standardization and indicator development. Economy-wide MFAs are consistent compilations of the annual overall material throughput of national economies, expressing all flows in tons per year. After the seminal work of Robert Ayres and Allen Kneese, MFA was “reinvented” in the 1990s as a consequence of the growing importance of the notion of sustainable development. In recent years, methods for economy-wide material flow accounting have been harmonized and a large number of material flow studies for both industrial and developing countries have been published to date.

As MFA accounts for materials entering and leaving a system, the mass balance

principle applies. Based on the conservation of mass principle it states that matter can neither be created nor destroyed. The mass balance principle can be formulated as: All material inputs into a system over a certain time period equal all outputs over the same period plus the stock increases minus the releases from stock. In principle net stock changes can be positive, indicating net accumulation, or negative, indicating stock depletion. In MFA, the mass balance principle is used to check the consistency of the accounts. It also provides one possibility to estimate the net additions to stock (NAS).

A flow is a variable that measures a quantity per time period, whereas a stock is a variable that measures a quantity per point in time. MFA is a pure flow concept. It measures the flows of material inputs, outputs and stock changes within the national economy in the unit of tonnes (= metric tonnes) per year. This means that in MFA stock changes are accounted for but not the quantity of the socio-economic stock itself. Although MFA is a flow concept, it is still important to define carefully what is regarded as a material stock of a national economy because additions to stocks and stock depletion are essential parts of the MFA framework. The definition of material stocks is also crucial in identifying which material flows should or should not be accounted for as inputs or outputs.

In MFA, three types of socio-economic material stocks are distinguished: artefacts, animal livestock, and humans. Artefacts are mainly man-made fixed assets as defined in the national accounts such as infrastructures, buildings, vehicles, and machinery as well as inventories of finished products.

Highly aggregated indicators are derived from MFA. These are: domestic extraction (DE), direct material input (DMI), domestic material consumption (DMC), physical trade balance (PTB), total material requirement (TMR), total material consumption (TMC), and net additions to stock (NAS). Overall, these indicators are intended to represent a proxy for aggregated environmental pressure comparable to aggregated energy use or aggregated land use. By relating these MFA indicators to macro-economic parameters (predominantly GDP) resource efficiency indicators can be derived which measure either material use per unit of GDP (resource intensity) or vice versa GDP per unit of materials used (resource productivity). For benchmarking national economies per capita values are commonly used (Haas et al. 2005).

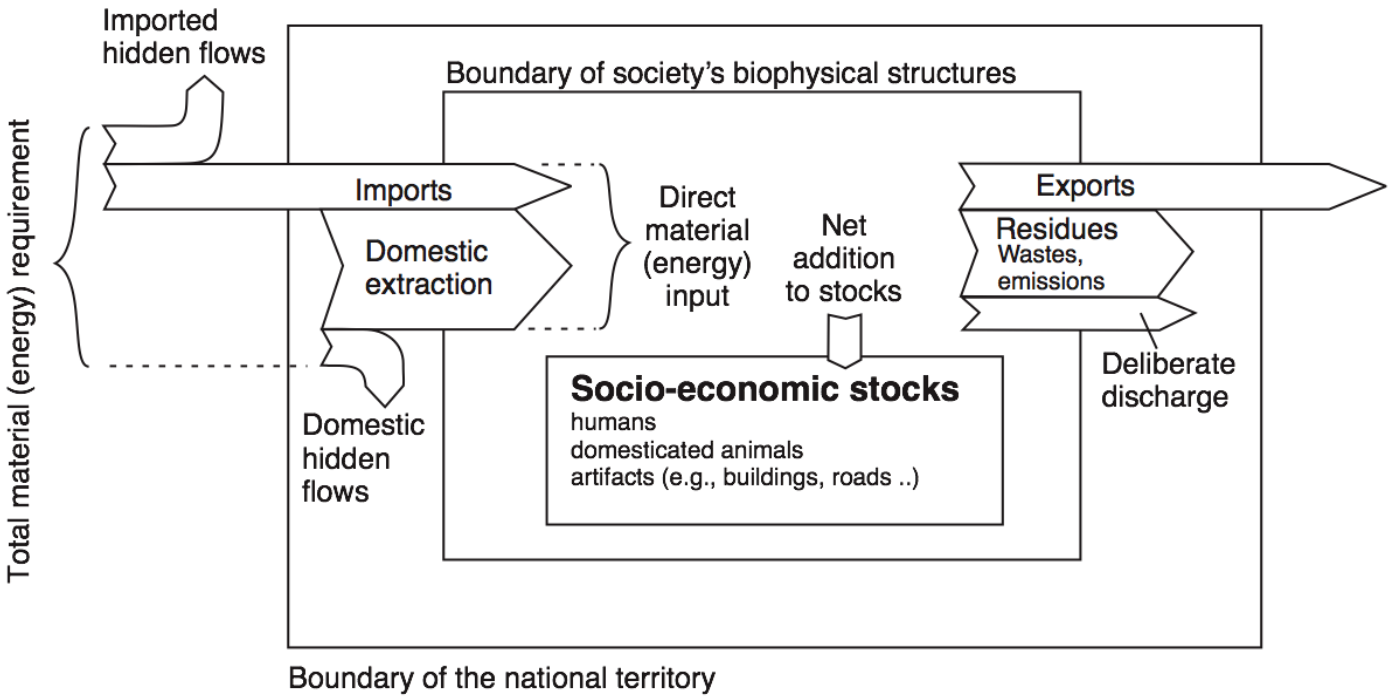


Figure 1: Society's material (and energy flows) within the M(E)FA framework.
(Source: Haberl et al 2004)

72.2 Input-Output Analyses (IO)

Input-output economics is a body of theory created by Nobel Prize laureate Wassily Leontief in the late 1930s and was originally designed to analyse the interdependence of industries in an economy. Since the late 1960s, IO analysis was extended to allow for addressing economy-environment relationships, focusing predominantly on energy use and pollution. Within industrial ecology, IO analysis has been applied increasingly to LCA (see below) in past years. Limited work has been done concerning the application of IO analysis to economy-wide MFA.

For input-output computations to deliver reliable results, an appropriate level of disaggregation by sectors or commodities is necessary. The most common IO approach is where the measurement to express the quantities of output of all sectors of the economy is money value (expressed in national currency and current prices). Such a table is called a monetary input-output table (MIOT). Another approach is a purely physical model based on an input output table where the quantities of the output of all sectors are measured in one single unit of mass. Such a table is called a physical input-output table (PIOT). Also for a PIOT sectoral input must equal sectoral outputs, according to the mass balance principle (Weisz 2006).This approach involves the exhaustive physical coverage of the movement (origins and uses) of most environmentally relevant materials induced by an economic region (sometimes disaggregated to the level of elements or simple chemical compounds). The PIOT

method traces how natural resources enter, are processed, and subsequently) as commodities, are moved around the economy, used, and finally returned to the natural environment in the form of residuals. It undertakes the detailed investigation of intersectoral physical flows of environmental resources inputs and commodity weights and residuals, and given this intersectoral specification and transactions matrix structure, has the ability to evaluate the cumulative environmental burden (total direct and indirect effect material requirements and pressures) of private consumption and other final demand for the products of different industries.

The third approach is a mixed unit model based on an input-output table where the output from the production sectors is measured in mass units and the output from the service sectors is measured in money value. In a mixed unit input-output table only total output, but not total input, can be computed, because total input would imply adding different units. It follows that no input output equation can be applied to a mixed unit input-output table (Weiz 2006).

72.3 Life-Cycle Assessment (LCA)

Life-cycle assessment (LCA) is an environmental management tool for identifying (and comparing) the whole life cycle, or cradle-to-grave, environmental impacts of the creation, marketing, transport and distribution, operation, and disposal of specific human artifacts. The approach considers direct and, ideally, related processes and hidden, nonmarket flows of raw materials and intermediate inputs, and waste and other material and energy outputs associated with the entire existence or “product chain” or “system”. The LCA procedure often involves a comparison of a small number of substitutable products assumed to provide a similar consumption service.

Life Cycle Assessment is conducted to answer questions such as:

*How do two different manufacturing processes for the same product compare in terms of resource use and emissions?

*What is the benefit of changing technology (chemicals)?

*What are the relative contributions of the different stages in the life cycle of this product to total emissions?

*What is the environmental footprint of my product, service, and company?

*How can I decrease it? What matters the most?

*What is my Carbon contribution to Green house effect?

Life Cycle Assessment (LCA) evaluates the mass balance of inputs and outputs of systems and to organize and convert those inputs and outputs into environmental themes or categories relative to resource use, human health and ecological areas (http://www.science-environment-consulting.com/en/life-cycle-assessment.html).

72.4 Life Cycle Inventory (LCI)

The quantification of inputs and outputs of a system, i.e. material and energy flows (Ekvall and Finnveden 2001) is called Life Cycle Inventory (LCI) (http://www.science-environment-consulting.com/en/life-cycle-assessment.html)

In the case of multi function processes an allocation problem arises in LCI: Concerning production processes with more than one product – this is: What share of the environmental burdens of the activity should be allocated to the product in question i.e. included in the LCI? The chosen solution to the allocation process can have a decisive impact on results of an LCI and a number of different solutions have been proposed including a standard procedure by the 'The International Organisation for Standardization' (ISO 14041, 1998) *(*Ekvall and Finnveden 2001).

72.5 Life Cycle Impact Assessment (LCIA)

Life Cycle Impact Assessment (LCIA) converts "inventoried" flows into simpler indicators. In a Life Cycle Impact Assessment (LCIA), essentially two methods are followed: problem-oriented methods (mid points) and damage-oriented methods (end points). In the problem-oriented approaches, flows are classified into environmental themes to which they contribute. Themes covered in most Life Cycle Assessment (LCA) studies are: Greenhouse effect (or climate change), Natural resource depletion, Stratospheric ozone depletion, Acidification, Photochemical ozone creation, Eutrophication, Human toxicity and Aquatic toxicity. These methods aim at simplifying the complexity of hundreds of flows into a few environmental areas of interest. EDIP and CML 2000 methods are examples of problem-oriented methods. The damage-oriented methods also start by classifying a system's flows into various environmental themes, but model each environmental theme damage to human health, ecosystem health or damage to resources. For example, acidification - often related to acid rain may cause damage to ecosystems (e.g., in the Black Forest in Germany), but also to buildings or monuments. In essence, this method aims to answer the question: Why should we worry about climate change or ozone depletion? EcoIndicator 99 is an example of a damage-oriented method.

Impact assessment methods have been developed as tools to broaden the information and context of Life Cycle Inventory (LCI) data, which refer mainly to mass and energy. The fact that LCI indicates that certain emissions are associated with certain environmental themes or impact categories does not imply that the studied product or system actually causes effects. It means however, that in the course of the life cycle, emissions are generated that contribute to a pool of similar emissions known to be associated with these environmental themes or impact categories. Used this way, Life Cycle Assessment is an appropriate tool for helping to determine to what extent a particular product, process or ingredients emissions may be associated with a particular impact category (http://www.science-environment-consulting.com/en/life-cycle-assessment.html).

References

Ayres, Robert U. and Kneese, Allen V. (1969): Production, Consumption and Externalities. In: American Economic Review 59(3), pp. 282-297

Ekvall, T. & Finnveden, G. (2001): Allocation in ISO 14041 – a critical review. Journal of Cleaner Production 9(3), pp. 197-208.

Fischer-Kowalski, Marina and Haberl, Helmut (1993): Metabolism and Colonization. Modes of Production and the Physical Exchange between Societies and Nature. In: Innovation - The European Journal of Social Sciences 6(4), pp. 415-442

Fischer-Kowalski, Marina and Weisz, Helga (1999): Society as a hybrid between material and symbolic realms – towards a theoretical framework of society-nature interaction. In: Advances in Human Ecology 8, pp. 215-251

Haas, W, Hertwich, E, Hubacek, K, Korytarova, K, Ornetzeder, M, Weisz, H (2005).: The Environmental Impacts of Consumption: Research Methods and Driving Forces. IIASA Interim Report IR-05-027 [April 2005, 96 pp]

Haberl, H., M. Fischer-Kowalski, F. Krausmann, H. Weisz, V. Winiwarter (2004): Progress towards sustainability? What the conceptual framework of material and energy flow accounting (MEFA) can offer. Land Use Policy 21(3), 199-213.

Weisz, Helga (2006): Accounting for raw material equivalents of traded goods. Acomparison of input-output approaches in physical, monetary, and mixed units. Social Ecology Working Paper 87. Vienna.

Weisz, Helga, Fischer-Kowalski, Marina, Grünbühel, Clemens M., Haberl, Helmut,

Websites:

Social Metabolism and MFA :
www.circa.europa.eu/Public/irc/dsis/pip/library?l=/material_accounts/compilation_reportingpdf/_EN_1.0_&a=d

http://www.uni-klu.ac.at/socec/inhalt/1860.htm

http://publikationen.lebensministerium.at/publication/publication/view/2625/28603

Local Studies Manual - social ecology working paperin progress – visit under
http://www.uni-klu.ac.at/socec/inhalt/1818.htm

73. Social Multi-Criteria Assessment

Multi-criteria assessment

Multi-criteria assessment (MCA) is a decision-making tool used to evaluate problems when one is faced with a number of different alternatives and expectations and wants to find the best solutions with regard to different and often conflicting objectives. The ability of MCA to deal with complex and unstructured decision problems in the sphere of environmental and natural resource management, which involve a number of conflicting ecological, environmental, societal and economic objectives, multiple interests groups and different languages of valuation is widely acknowledged.

MCA constitutes both a framework for structuring decision problems, as well as a set of methods to generate preferences among alternatives. MCA has the potential to take into account conflicting, multidimensional, incommensurable and uncertain effects of decisions explicitly enabling it to focus more on the “decision process” itself, and not on a final result (Munda, 2008).

A multi-criteria problem is characterized by the presence of a finite set of alternatives (for instance alternative corridors for a railway or different design options for a regional transportation system) and the existence of different (and often conflicting) evaluation criteria under which we evaluate each alternative (e.g. impacts on land use, travel costs, people affected – see http://www.ceecec.net/wp-content/uploads/2008/09/TAV-matrix.JPG for an example of alternatives and criterion in the context of the CEECEC case study on TAV). The MCA problem may then be represented in the form of a matrix (alternatives x criteria) depicting the evaluation of each alternative regarding to each criterion.

Supposing that it is possible to evaluate each alternative in relation to each criterion, we can obtain a weak ordering of the alternatives for each criterion, ranging from best to worst. The multi-criteria decision problem consists of ranking the alternatives according to an ordering that is a legitimate synthesis of the criteria. Generally, there is no solution optimizing all criteria at the same time and compromises have to be found. A wide set of multi-criteria methods have been developed for this purpose. These methods have particular features regarding information requirements, criteria assessment, modeling of preferences and decision rules.

MCA in a participatory context

Multicriteria methods may provide a powerful framework for policy analysis in the context of sustainability problems, since they can accomplish the goals of being inter- or multi-disciplinary (accounting for the multiple dimensions present), participatory (open to all stakeholders), and transparent (Munda, 2008). Stakeholder participation may be included in the overall structure of the MCA process: alternatives and criteria generation, evaluation of alternatives and discussion of results (Antunes et al., 2006).

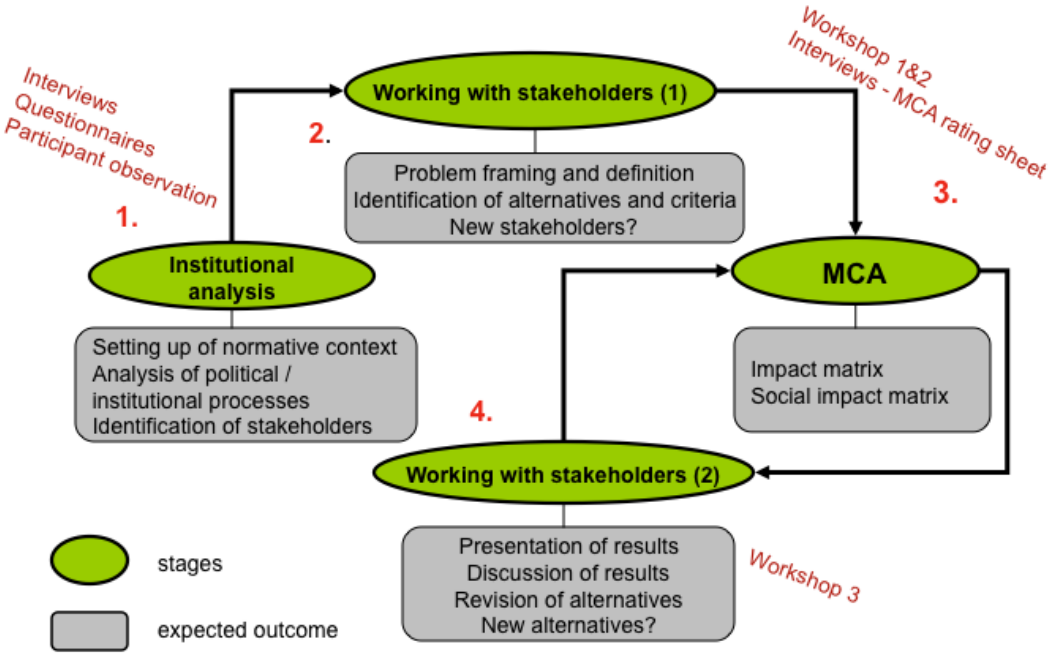
The subjectivity of MCA, common to every evaluation process, should be treated with caution. One possible way of dealing with subjectivity is to design participatory MCA processes where criteria selection, weighting and aggregation steps are performed with the input of a broader group of actors, in order to account for different interests and values

(De Marchi et al., 2000; Munda, 2008) or combining MCA with participatory techniques (Antunes et al., 2006; Kallis et al., 2006). Each manner of conducting MCA is closely connected to participation, as a way to validate the overall structure and framing of the analysis. It should however be noted that participation is a necessary condition but may not be sufficient for reaching transparency and accountability.

73.1 Social Multi-Criteria Evaluation (SMCE)

A way of approaching the issue of participation in MCA is through the adoption of a Social Multi-criteria Evaluation (SMCE) framework, which defines the concept of evaluation as a mixture of representation, assessment and quality check connected with a given policy problem, based on a specified objective (Munda, 2008). SMCE aims to foster transparency, reflection and learning in MCA decision processes, simultaneously integrating political, socio-economic, as well as ecological, cultural and technological dimensions of the problem.

For the purpose of obtaining evaluation criteria, SMCE examines stakeholders' objectives and expectations, trying to avoid as much as possible a technocratic approach. As various dimensions are taken into account, the main goal is to find a balance between them, aiming at "compromise solutions" (Munda, 1995). Weights in



Source: Adapted from Kallis et.al. 2006; Paneque et al., 2009.

Figure 1: Steps in an SMCE process

SMCE are understood as importance coefficients and not as trade-offs. Aggregation conventions used are non-compensatory mathematical algorithms, meaning that criteria with smaller weights can be also influential, which excludes the complete compensability concept. Additional features are profound social actor analysis and conflict analysis (equity matrix for consensus seeking). NAIADE, the Novel Approach to Imprecise Assessment and Decision Environments is a discrete SMCE method developed by Munda (1995) that combines the use of mixed information types and conflict analysis. NAIADE produces a ranking of alternatives according to the set of evaluation criteria, and indications of the distance of the positions of the various interest groups and a ranking of the alternatives according to actors' impacts or preferences (Munda, 2008). **Figure 1** illustrates the steps typically undertaken in a SMCE process, and descriptions of the application of SMCE frameworks to different sustainability problems are described in Munda, 2008; de Marchi et al. 2000;and Antunes et al. 2010.

References

Antunes, P., Santos, R., Videira, N., 2006. Participatory decision making for sustainable development – the use of mediated modeling techniques, Land Use Policy, 23, 44-52.

Antunes, P., Karadzic, V., Santos, R., Beça, P., Osann, A., 2010. Participatory multi-criteria analysis for the evaluation of irrigation management alternatives. The case of Caia irrigation area, Portugal, International Journal of Agricultural Sustainability (submitted).

De Marchi, B., Funtowicz, S., Cascio, S. L., Munda, G., 2000. Combining participative and institutional approaches with multicriteria evaluation. An empirical study for water issues in Troina, Sicily. Ecological Economics, 34, 267-282.

Kallis, G., Videira, N., Antunes, P., Guimarães Pereira, A., Spash, C. Coccossis, H. Corral Quintana, S., del Moral, L., Hatzilacou, D., Lobo, G., Mexa, A., Paneque, P., Pedregal, B., Santos, R. (2006). Participatory Methods for Water Resources Planning and Governance. Environment and Planning C: Government and Policy. 24, 215-234.

Munda, G., 1995. Multicriteria evaluation in a fuzzy environment. Theory and applications in ecological economics. Physica-Verlag, Heidelberg.

Munda, G., 2008. Social Multi-Criteria Evaluation for a Sustainable Economy, Springer-Verlag, Berlin Heidelberg.

Websites

NAIADE http://wikiadapt.org/index.php?title=NAIADE.

74. Sustainable Extraction

Neoclassical versus ecological economics on extraction

The economics of natural resources has a relatively long history dating back to Malthus and Jevons in the 19th century and to Hotelling in the 1930s. Hotelling (1931) developed an influential theory of depletion of oil or mineral deposits in which he described optimal non-renewable resource extraction. In short, Hotelling proposed a way of calculating the optimal rate of depletion for such resources (based on a given discount rate). In standard economics it was believed that if resources were scarce and if market participants knew they were scarce, then resource prices would rise and alternative resources would become profitable. In this way, scarce resources would little by little be substituted by other resources. This corresponds to the model of weak sustainability.

Standard economics is in general much more optimistic than ecological economics, usually showing a great deal of confidence in the ability of prices and market processes to steer the behavioural responses of producers and consumers. Unsustainable extraction or, better said, growing scarcity of a given natural resource is argued to lead to responses of substitution, savings and recycling of materials, and technological innovations at process and product levels, through price information. Ecological economics, in contrast, is more pessimistic about such responses and often refers to the entropy law implying irreversible changes (Georgescu-Roegen, 1971). Accordingly, ecological economics emphasizes strong sustainability. It argues that extraction of non-renewable resources cannot be "sustainable" by definition and that it is crucial to acknowledge this point. However, the sustainable extraction of renewable resources such as wood or fish is possible if related to a careful understanding of reproduction and growth rates.

A note on economic growth

Ecological economists directly link economic growth to the increased extraction of natural resources (renewable or non-renewable). Some even link it to environmental conflicts. Most researchers in this school of thought state that damages to nature and environment have assumed such proportions that continuing growth will almost surely lead to ecological disasters. In this context, soil erosion, deforestation, enhanced global warming and loss of biodiversity are regarded as urgent problems. Ecological economists express serious worries about the resilience of ecosystems, which depends on the complex connection between global bio-geo-chemical processes and "life-support" functions of the biosphere, which are presently under

severe pressure from human activities. In terms of methods of analysis of growth-versus-environment, standard economics has recently focused attention on partial empirical analysis through studies that examine de-linking between certain environmental indicators and income per capita ("environmental Kuznets curves"). Instead, ecological economics relies more on complex systems analysis that incorporates feedback mechanisms between natural resource extraction, economy, growth, environmental quality, population growth, welfare level and health status.

As an illustration of this approach, ecological economists have examined the metabolism of extractive industries. They have for instance shown that the extraction of natural resources is associated with the transformation of enormous amounts of energy, both in the extraction process itself and in subsequent processes of concentration, smelting, filtering and refining. In order to extract resources from supplies with low concentrations of a desired material, the amount of energy use per useful unit of output needs to rise (see EROI), and increasingly so. This means that as the economy grows over time, energy use will follow. Technological improvements and recycling can slow down the unfolding of such patterns, but not permanently postpone them. This model of resource extraction takes a significantly broader approach than the traditional, Hotelling-type models of standard environmental economics.

75. Tragedy of the Commons: Hardin's Mistake

Concept origin

The concept of "The Tragedy of the Commons," stems from Garrett Hardin's influential article, in which he referred to all common-pool natural resources that were not either government or privately owned. As a metaphor he envisioned a pasture open to all, in which each herder received an immediate individual benefit from adding animals to graze on the pasture and suffered only delayed costs (with his fellow herders) from overgrazing. Hardin (1968) concluded: "Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit—in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons".

Hardin further states that "in a reverse way, the tragedy of the commons reappears in problems of pollution" i.e inputs into the commons such as "sewage or "chemical, radioactive, and heat wastes into water" (Hardin, 1968) He writes: "The rational man finds that his share of the cost of the wastes he discharges into the commons is less than the cost of purifying his wastes before releasing them". Since this is true for everyone, we are bound to "foul our own nest," so long as we behave only as independent, rational, free-enterprisers" (Hardin, 1968) Hardin gives an example in the development of maritime fisheries. "Maritime nations still respond automatically

to the shibboleth of the 'freedom of the seas'. Professing to believe in the 'inexhaustible resources of the oceans', they bring species after species of fish and whales closer to extinction" (Hardin, 1968)

Avoidance of the tragedy of the commons, according to Hardin will require coercive laws, but should be a "mutual coercion" agreed by the majority of people. Most importantly, he argues, there is a need for coercion over reproduction: "The most important aspect of necessity that we must now recognise, is the necessity of abandoning the commons in breeding. No technical solution can rescue us from the misery of overpopulation. Freedom to breed will bring ruin to all" (Hardin, 1968). He also states "to couple the concept of freedom to breed with equal right to the commons is to lock the world into a tragic course of action" (Hardin, 1968).

75.1 Enclosure of the Commons

Regarding human rights Hardin argues that every restriction on commons rights ("enclosure of the commons") involves the infringement of somebody's personal liberty. But, he says, infringements made in the distant past are accepted today as they are not seen as a "loss", while "newly proposed infringements" are "vigorously opposed" with "cries of rights and freedom". " But what does freedom mean?" he asks, and concludes that, as Hegel put it "freedom is the recognition of necessity" and that the underlying problem is that if we continue to insist on all present-day freedoms we will bring "universal ruin" (Hardin, 1968)

Comment

Many authors have pointed out that Hardin mistakenly wrote "commons" when he meant "open access". Nagendra and Ostrom (2008) say that: "A common-pool resource can be managed under any of the following property-rights regimes: government ownership (where a formal government ranging in size from a local city all the way to national government claimed ownership of the resource and the right to fully determine who could or could not use and under what circumstances); private ownership (where a single individual or private firm has full claims to determine use patterns; community or common property ownership (where a group of individuals shares rights to ownership); or "no ownership" or "open access," which is what Hardin assumed in his illustrative case." Therefore open access is only one out of four general possibilities that can relate to a common-pool resource.

Critiques

According to Vatn (2005) any property regime except open access – be it private, common or state/public property – may have very precise rules or norms establishing the necessary incentives for resource use. However, such property regimes also have incentive problems when externalities appear due to the "fact that resources and natural processes are interconnects – linking various resource uses necessarily to waste production." In economic terms he states "this can be translated into 'high costs of keeping different agents and their uses apart'. If it were possible to

costlessly demarcate all streams of benefits, all processes, there would be no external effects. Each agent would own and consume only his or her own parts". But given the existing interrelations in natural resource systems, this is impossible. And even if it were possible, it would ruin the quality of the resources, since their very functioning depends on their working together.

Evidence from the field and from research around the world has emerged to show the multiple rules-in-use found in successful commons regimes around the world. To be effective, rules must be generally known and understood, considered relatively legitimate, generally followed, and enforced. "Effective, sustainable community management of common property natural resources is also more likely to occur when the boundary of the resource is easy to identify, changes in the state of the resource can be monitored at a relatively low cost, the rate of change in resource condition and in the socioeconomic and technological conditions of users remains moderate, communities maintain frequent social interactions with each other that increase trust within the community (thereby increasing social capital), outsiders can be relatively easily excluded from accessing the resource (preventing large-scale invasion of the resource by outsiders), and rule infractions are monitored and sanctioned (Nagendra and Ostrom, 2008).

Nagendra and Ostrom (2008) conclude that: "Just as government ownership does not represent a final solution for the sustainable use of natural resources, […] neither is community management a panacea for all the ills that plague natural resource management. Instead, much more attention needs to be paid to the adaptive crafting of institutions that fit socio-ecological systems, and policy scientists need to recognize diversity in the institutions that can assist human users to devise arrangements for sustainable management of a resource" (Nagendra and Ostrom, 2008).

References

Hardin, G. (1968): The Tragedy of the Commons. Science 162 (3859), pp. 1243-1248.

Nagendra, H., Ostrom, E. (Lead Authors) and Saundry, P. (Topic Editor) (2008): Governing the commons in the new millennium: A diversity of institutions for natural resource management. In: Encyclopedia of Earth. Eds. Cutler J. Cleveland (Washington, D.C.: Environmental Information Coalition, National Council for Science and the Environment). [First published in the Encyclopedia of Earth November 16, 2007; Last revised August 12, 2008; Retrieved January 24, 2010]. <http://www.eoearth.org/article/Governing_the_commons_in_the_new_millennium:_A_diversity_of_institutions_for_natural_resource_management>

Ostrom, E. (2007): Challenges and growth: the development of the interdisciplinary

field of institutional analysis . Journal of Institutional Economics 3 (3), pp. 239–264

Vatn, A. (2005), Institutions and the Environment, Cheltenham, UK: Edward Elgar.

Websites:

http://www.population-growth-migration.info/index.php?page=literature.html

Talk given by Elenor Ostrom: http://www.youtube.com/watch?v=ByXM47Ri1Kc

76. Transaction Cost

Definition

In economics, a transaction cost is a cost incurred in making an economic exchange. For example, when buying a good, the cost paid integrates not only the price of the product itself, but also the energy and efforts required to find out which variety is preferred, where to get it and at what price, its cost of travelling, the cost of making a legal contract and so on. All of these costs, except for the price of the product itself, represent transaction costs.

Use in Ecological Economics

For ecological economics, an important focus is placed on the role of transaction costs when discussing Coasian bargaining, and in general in the management of emissions trading and in the use of incentive mechanisms for environmental protection. Environmental governance typically involves administrative transactions rather than market transactions. Here are some examples of well known transactions:

- Search and information costs: costs associated with market research
- Bargaining costs: costs of making an acceptable agreement with the other party.
- Policing and enforcement costs: costs of making sure the other party sticks to the terms of the contract and of taking appropriate actions, mainly through the legal system, if this is not the case.

For example, McCann and Easter (1999) measure the magnitude of transaction costs associated with four different policies to reduce non-point source (NPS) pollution. In their study, transaction costs integrate information collection and analysis, enactment of enabling legislation including lobbying costs, design and implementation of policy and support and administration of on-going programmes, monitoring/detection, and persecution/inducement costs. They directly measure through interviews with program staff and others the amount of labour input required, which then is translated into monetary costs. The results show that the tax on

fertilizer has the lowest transaction cost and the expansion of a permanent conservation easement program (below) has the highest transaction cost.

Conservation easement programs are those in which ownership rights to land are transferred to a private charitable conservation organization or government agency without transferring ownership of the land. The organization or agency then "holds" those rights (the easement) in perpetuity, even if the land is sold or bequeathed by the landowner to another party)

Various emissions trading systems have been increasingly used to replace traditional command-and-control approach in environmental regulation. However, transaction costs are generally high in some marketable permit programs. As a consequence potential gains from trade are far from being realized. Several factors have been identified as contributors to high transaction costs in emissions trading:

1. the inability in some programs of buyers and sellers to identify each other;
2. regulatory approval is costly and lengthy;
3. firms face enormous uncertainty in anticipating how regulators would determine their baseline emission levels and emission reduction.

Issues

For individual products traded in markets, transaction costs are relatively low and sufficiently overcome by the agents performing the transaction to complete an exchange. But in reality, transaction costs are likely to be very important each time an externality affects more than a very few agents, which is frequently the case. For example, a farmer who pollutes his water supply may be one of numerous upstream farmers affecting thousands of downstream neighbours. Bringing all the relevant agents to the negotiating table would be almost impossible, and even if it could be achieved, free-riding could become a problem. For example, if a person lives on the banks of a stream polluted by farmers and if her neighbours agree to pay to reduce pollution, she would prefer that level of reduction for free to even more reduction at a positive cost to herself.

Beside the lack of a standardized definition, another shortcoming comes from the difficulty in estimating transaction costs. This is namely because production and transaction costs are jointly determined, so that it is hard to estimate transaction costs separately. In empirical studies, a direct measurement of transaction costs is simply the economic value of resources used for locating trading partners and executing transactions, but it can also be measured by calculating the difference between the price paid by the buyer and the one received by the seller.

References:

R. Coase, 1961, "The problem of social cost." *Journal of Law and Economics* 3:1-44

B. Colby, 1990, "Transaction costs and efficiency in western water allocation", *American Journal of Agricultural Economics* 72: 1184-92.

L. McCann and K.W. Easter, 1997, “Transaction costs of policies to reduce agricultural phosphorous pollution in the Minnesota River”, *Land Economics* 75 (3): 402-414

77. Uncertainty and Risk

Definitions and taxonomies

The notion of “uncertainty” is used in many scientific fields, often encompassing a multiplicity of related concepts. In broad terms, uncertainty may be defined as being any deviation from the unachievable ideal of completely deterministic knowledge of a relevant system (Walker et al., 2003).

Uncertainty characterizes most assessment, policy and management processes that have unpredictable consequences. In a risk assessment context, the United States Environmental Protection Agency refers to uncertainty as “our inability to know for sure - it is often due to incomplete data” (http://www.epa.gov/riskassessment/). In the Millennium Ecosystem Assessment, uncertainty is defined as “an expression of the degree to which a future condition (e.g., of an ecosystem) is unknown. Uncertainty can result from lack of information or from disagreement about what is known or even knowable” (MEA, 2003).

Uncertainty may have different types of sources, from quantifiable errors in the data to ambiguously defined terminology or uncertain projections of human behavior. Uncertainty measurements can therefore be represented by quantitative metrics (e.g., a range of values calculated by various models) or by qualitative statements (e.g., reflecting the judgment of a team of experts) (MEA, 2003).

Several nomenclature systems have been developed for describing the different types of uncertainties. For example, Funtowicz and Ravetz (1990) explored the differences between three sorts of uncertainty:

- **Inexactness**, i.e. a technical level of uncertainty involving the random and systematic errors in empirical quantities;

- **Unreliability**, which is related to methodological uncertainties arising, for example, from an incomplete understanding and from the approximations made when describing the structural and functional characteristics of a system under study;

- **Border with ignorance**, which refers to an epistemological level of uncertainty (e.g. omissions of processes and parameters due to ignorance – “ignorance of ignorance”).

In a context of environmental contingencies and crisis, the checklist developed by De Marchi (1995) supports the identification and ranking of different types of uncertainty (Table 1).

As indicated in **Table 1**, there is an ethical dimension to decision-making and the handling of uncertainty when the lives of others are at stake (e.g. decision to approve new drugs or chemicals that have uncertain human health and environmental consequences). Within this context, Tannert et al. (2007) developed the “Igloo of Uncertainty” (**Figure 1**) wherein dangers and risks are discriminated in the field of uncertainty – a danger is present regardless of choice, whereas a risk is either optionally accepted or imposed.

Table 1 – Types of uncertainty in environmental emergencies (Source: http://www.nusap.net)

Type	Definition
Institutional	Refers to the role and actions of institutions and their members and stems from the diversity of cultures and traditions, divergent missions and values, different structures and work styles among personnel of different organizations. High institutional uncertainty can hinder collaboration or understanding among agencies, and can make the actions of institutions difficult to predict.
Legal	It is relevant when agents need to consider future contingencies of personal liability for their actions (or inactions). High legal uncertainty may result in defensive responses in regard to both decision-making and release of information. Legal uncertainty may also play a role where actions are conditioned on the clarity or otherwise of a legal framework in allowing one to predict the consequences of particular actions.
Moral	Arises from the underlying moral issues related to action and inaction in a given issue. De Marchi notes that "moral uncertainty is linked to the ethical tradition of a given country be it or not enacted in legislation (juridical and societal norms, shared moral values, mores), as well as the psychological characteristics of persons in charge, their social status and professional roles". Moral uncertainty would typically be high when moral and ethical dimensions of an issue are central and participants have a range of understandings of the moral imperatives at stake.
Proprietary	Arises from asymmetries between potential users of information and knowledge about an issue. Some people or groups have information that others don't and may assert ownership or control over it. Proprietary uncertainty is typically high when knowledge plays a key role in assessment, but is not widely shared among participants.
Scientific	Arises from the scientific and technical dimensions of a problem and is intrinsic to the processes of risk assessment and forecasting.
Situational	Relates to "the predicament of the person responsible for a crisis, either in the phase of preparation and planning, or of actual emergency. It refers to individual behaviors or personal interventions in crisis situations" (De Marchi, 1994) and as such represents a form of integration over the other six types of uncertainty. That is, it tends to combine the uncertainties one has to face in a given situation or on a particular issue. High situational uncertainty would be characterized by situations where individual decisions play a substantial role and there is uncertainty about the nature of those decisions.
Societal	Arises when different communities (with different sets of norms, values, and manner of relating characteristic of their societies) have different approaches to decision-making and assessment. Societal uncertainty would typically be high when decisions involve substantial collaboration among groups characterized by divergent decision-making styles.

Finally, it is also important to clarify the differences between “uncertainty”, “risk” and “ignorance” in relation to different states of knowledge and associated examples of public action (**Table 2**), since what is sometimes loosely referred to as “uncertainty” often mixes up these concepts (EEA, 2001).

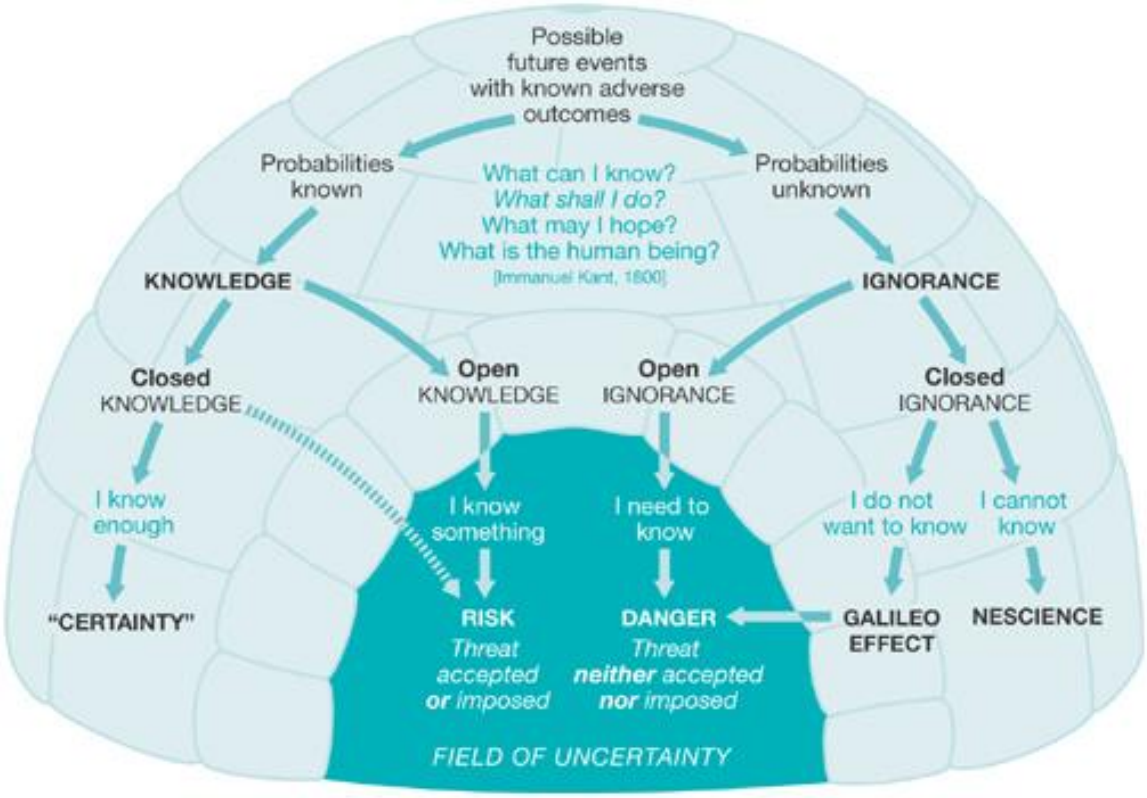


Figure 1: The Igloo of Uncertainty
(Source: Tannert et al., 2007)

Table 2 – Uncertainty, risk, ignorance and their relationship with different states of knowledge and suggested public policy action

(Source: EEA, 2001)

Concept	State of knowledge	Suggested action
Uncertainty	• Known impacts • Unknown probabilities	*Precautionary action* Action taken to reduce potential hazards
Risk	• Known impacts • Known probabilities	*Prevention* Action taken to reduce known risks
Ignorance	• Unknown impacts • Unknown probabilities	*Precaution* Action taken to anticipate/identify/reduce the impact of “surprises”

Dealing with uncertainty

According to the Post-Normal Science framework, the management of uncertainties should rely on explicit guidelines and credible set of procedures such as those provided in the NUSAP notational system. The NUSAP categories stand for "Numeral", "Unit", "Spread", "Assessment" and "Pedigree", enabling the different sorts of uncertainty in quantitative information to be expressed in a standardized way and presented transparently to all the actors involved in a policy process. For extensive guidance on tools for the assessment and communication of uncertainty, see the NUSAP website at http://www.nusap.net.

Adopting a precautionary approach in a context of uncertainty is often recommended as a strategy for public policy action. The precautionary principle is an overarching framework that governs the use of foresight in situations characterized by uncertainty and ignorance, where there are potentially large costs to both regulatory action and inaction (EEA, 2001). The sound application of the precautionary principle to issues of complexity, uncertainty and controversy requires the support of key elements of "good governance", such as fairness, transparency and accountability (EEA, 2001).

Scenarios and forward-looking studies are practical tools that can help to explore key uncertainties and their implications across a wider range of contrasting futures.

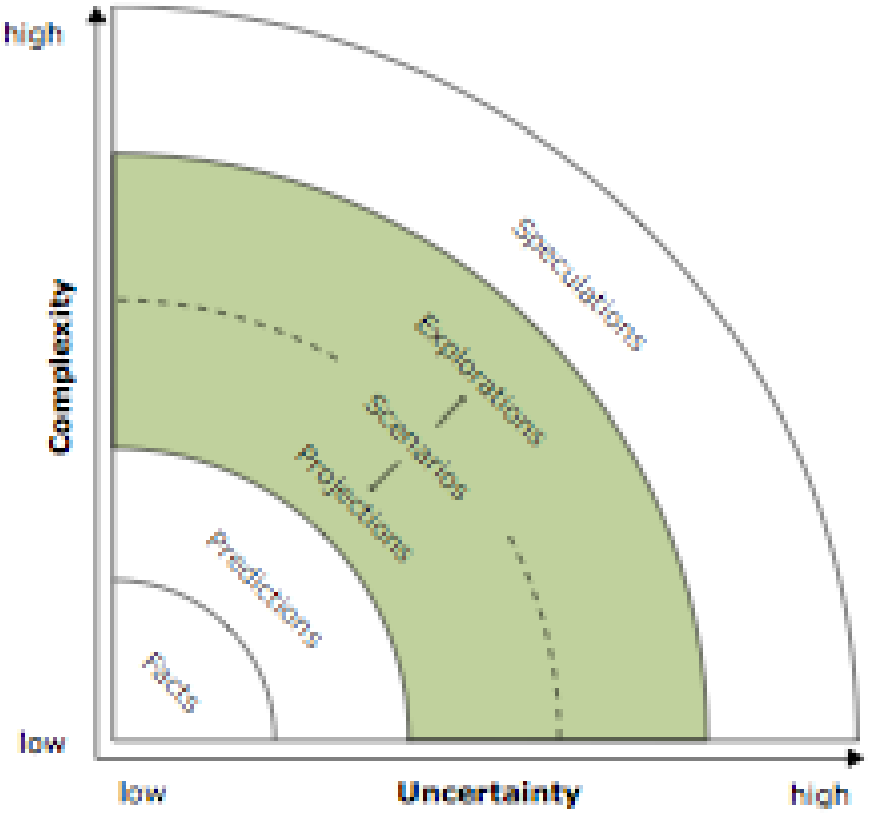


Figure 2: The role of forward-looking assessments in understanding future environmental challenges and dealing with complexity and uncertainty
(Source: Zurek and Henrichs, 2007)

As depicted in **Figure 2**, in the face of future uncertainties, scenarios and forward-looking assessments and also visions, can help to structure and explore choices by revealing their possible long-term consequences, thus supporting strategic planning and decision-making.

References

De Marchi, B., 1995, Uncertainty in Environmental Emergencies: A Diagnostic Tool, *Journal of Contingencies and Crisis Management*, **3** (2), pp. 103-112.

Funtowicz, S., Ravetz, J. 1990. *Uncertainty and Quality in Science for Policy*. Kluwer Academic Publishers, the Netherlands.

MEA - Millennium Ecosystem Assessment, 2003, *Ecosystems and Human Well-Being: A Framework For Assessment*, Millennium Ecosystem Assessment Series, Island Press.

Tannert, C., Elvers, H.D., Jandrig, B., 2007, The ethics of uncertainty, *EMBO – European Molecular Biology Organization reports*, 8 (10), pp. 892-896.

Walker, W., Harremoes , P., Rotmans, J., Van Der Sluijs, J., Van Asselt, M., Janssen, P., Krayer Von Krauss, M., 2003. Defining Uncertainty. A Conceptual Basis for Uncertainty Management in Model-Based Decision Support, *Integrated Assessment*, Vol. 4, No. 1, pp. 5–17.

Zurek, M., Henrichs, T., 2007. Linking scenarios across geographical scales in international environmental assessments. *Technological Forecasting and Social Change.*

Websites:

www.nusap.net

alba.jrc.it/main.html

leidraad.pbl.nl/

78. Value Incommensurability

Conventional versus ecological economists

Values are often incommensurable. This means that they cannot be measured in the same units. The environment is often a site of conflict between competing values

and interests represented by different classes and groups. How are such conflicts to be understood? The approach of standard economics is to use of a *common unit* – a monetary numeraire – for all the different values and then to look for a compromise (a trade-off) between all of them within a market context. By "values" we understand what is considered important, but what do we really mean: conservation of nature? sacredness? livelihood? aesthetics? money? national sovereignty? Typically, conventional economists apply monetary compensation to an injured party in order to solve conflicting claims. In some cases, like when asking for redress in a court of law in a civil suit, this is all that can be done: asking for money as compensation for damages. This approach assumes therefore the existence of *value commensurability*, that is, that all values can be translated into money.

Ecological economists, in contrast, accept *value incommensurability* (Martínez-Alier *et al.*, 1998). If a territory is sacred, what is its value in money terms? If the livelihood of poor people is destroyed, can money really compensate for it? If we leave without generations with a changed climate, can we really compensate them in money terms? Nobody knows indeed how to convincingly estimate the monetary price of cultural, social or ecological impacts of deforestation and biodiversity loss, for instance. Instead of appealing to a unique numeraire, other ways are available for resolving problems related to a plurality of values.

The example of Southern Cameroon

In Southern Cameroon for instance, the valuation languages used by local populations are diverse. Most of the time, it is not the language of Western conservation (e.g. "biodiversity protection") nor it is one of standard economics (e.g. "monetary compensation"): local populations use the languages of defence of human rights, urgency of livelihood, defence of cultural identity and territorial rights, and respect for sacredness. The "Pygmy" Baka provide an illustration of this. Because of logging, the Baka lose bush meat, territories, trees, and collection spots for forest products. Another complaint is that they often suffer from noise pollution from chain saws and trucks. In the Baka cosmology, when God created the world (humans and Nature), its favourite activity was to listen to the bees. So, humans had to stay quiet in order not to disturb God. But one day, some Baka began to make noise in the forest and God punished them by transforming them into wild animals. Noise is thus considered by Baka as a severe impact of logging since it is directly related to their religion, creating a "spiritual prejudice". In view of this, it is misleading – as standard economists do – to try to reduce such a diversity of languages to a single monetary measure and to put a price on forest degradation.

Conflict resolution

Conventional conflict resolution through cost benefit analysis and monetary compensation is therefore inappropriate because it denies the legitimacy of other languages. It simplifies complex value systems related to the environment into monetary units. Moreover, if the only relevant value becomes money, then poor

people are disadvantaged as their own livelihoods are cheaply valued on the market, so compensation will be minimal. Therefore, market prices and monetary valuation are themselves tools of power through which some sectors impose their own symbolic system of environmental valuation upon others, thereby defining exchange values and allowing the trade-off of economic benefits and socio-environmental costs in their own favour. In fact, we realize that poor people are well advised to defend their interests in languages different from that of monetary compensation for damages, because in the capitalist sphere the Lawrence Summers' principle ("the poor sell cheap") is operative.

It appears that only a truly democratic debate can solve valuation contests. Social multi-criteria evaluation is a tool from ecological economics that allows the comparability of plural values and sometimes helps to reach compromise solutions. It also shows what coalitions of actors are likely to be formed around different alternatives (Munda, 1995). In reality, however, it is usually the most powerful actor that imposes its own viewpoint and language of valuation. In this context, quite obviously, conflicts are sometimes the only way to change power relations that favour dominant actors and to advance towards equity and sustainability (Martínez-Alier, 2002).

References

Martínez-Alier, J., Munda, G. and O'Neill, J., 1998. Weak comparability of values as a foundation for ecological economics. *Ecological Economics*, 26: 277–286.

Martínez-Alier, J., 2002. *The environmentalism of the poor: a study of ecological conflicts and valuation*. Cheltenham: Edward Elgar.

Munda, G., 1995. *Multi-criteria evaluation in a fuzzy environment. Theory and applications in ecological economics*. Heidelberg: Physica-Verlag.

79. Virtual Water and Water Footprints

Definition

Humans consume water directly for drinking, cooking and washing, but much more for producing commodities such as food, paper, cotton clothes, etc…The amount of water that is used in the production processes of commodities during their entire life cycle is referred to as the *Virtual Water* contained within them. 'Virtual' water can be further divided into blue water (water that evaporates from rivers, lakes, or aquifers in production processes such as irrigation), green water (rainfall that evaporates during crop growth), and grey water (water polluted after agricultural, industrial and household use).

The *water footprint* of an individual, community or business is defined as the total volume of freshwater that is used to produce the goods and services consumed by that individual or community or produced by the business

Some sample water footprints are set out below:

- The production of one kilogram of beef requires 16 thousand litres of water.
- To produce one cup of coffee we need 140 litres of water.
- The water footprint of China is about 700 m^3 per year per capita. Only about 7% of the Chinese water footprint falls outside China.
- Japan with a footprint of 1150 m^3 per year per capita, has about 65% of its total water footprint outside the borders of the country.
- The USA water footprint is 2500 m^3 per year per capita. (source:www.waterfootprint.org)

Application

Since the per capita consumption of Virtual Water contained in our diets varies according to the type of diet (from 1m3/day for a survival diet, to 2.6m^3/day for a vegetarian diet and over 5m^3 for a USA style meat based diet) it is clear that the moderation of diets (reducing meat consumption) can have a big impact on virtual water use. However, the precise impact of a water footprint depends entirely on where water is taken from and when. An increased footprint in an area where water is plentiful is unlikely to have an adverse effect, but an increase in an area experiencing scarcity could result in the drying up of rivers, the destruction of habitats and livelihoods, and the extinction of species – in addition to affecting agricultural prices, supplies and local economies. Some proponents of virtual water argue for the need for a labelling scheme, with the water footprint of a product clearly set out so as to encourage demand management. This would help consumers and policy makers recognise links between production and consumption.

On the policy level, a water scarce country can import products that require a lot of water in their production (import of Virtual Water) to relieve pressure on its own resources. This is a strategy first adopted by Israel, which imports almost all cereals. Conversely, arguments are made that dry countries such as Spain should not be exporting tomatoes with a high virtual water content to wet Northern Europe. Exports of paper pulp, soybeans, or ethanol from Latin America to Europe or China imply large exports of virtual water. This type of global Virtual Water trade has geo-political implications: it induces dependencies between countries.

Critiques of Virtual Water Accounting

Virtual Water proponents believe insufficient attention is placed on demand management in comparison to supply management. In their opinion consumer demand management through education/information, labelling schemes has been overlooked because consumers and policy makers don't recognise links between production and consumption.

One problem with virtual water labelling is that water content should be considered bearing in mind its geographical and temporal importance (50 litres of water taken from England is not the same as from the Sahara, or from Valencia in summer (high tourist season when water is scarce). Similarly, an agricultural product grown with rainwater is not comparable with one grown with irrigated water extracted from non-renewable ground water. Thus virtual water gives no indication if water is being used within sustainable extraction limits, which can change annually based on rainfall. Finally, the virtual water argument can also have consequences politically, particularly regarding equity. Water released from one use will not necessarily be used more efficiently, or distributed more equitably. If water is released from agriculture, and farmers grow lower-value crops with less water requirements, the released water could easily be absorbed by urban users, or by the industrial sector instead of being distributed more equitably among the rural poor.

Websites:

www.waterfootprint.org

www.worldwatercouncil.org

http://www.waterfootprint.org/index.php?page=cal/waterfootprintcalculator_indv

80. Weak vs. Strong Sustainability

Sustainability and capital stocks

The concept of 'sustainable development' was first introduced by the International Union for Conservation of Nature and Natural Resources (IUCN) in 1980, but only gained wider societal and political relevance in 1987 with the publication of the report by the UN World Commission on the Environment and Development. This report, often referred to as the 'Bruntland report' (WCED, 1987), defines sustainable development as 'development that meets the needs of the present, without compromising the ability of future generations to meet their own needs'.

Capital may be defined as a stock that possesses the capacity to generate a flow of goods and services that satisfy human needs. We can disaggregate the capital stock available to generate this flow into four different types of capital (Costanza and Daly, 1992; El Serafy, 1991; Ekins et al., 2003):

- **Manufactured capital**, comprising material goods – tools, machines, buildings, infrastructure – which contribute to the production process but do not become embodied in the output and usually are 'consumed' in a period of time longer than a year;

- **Human capital**, that comprises all individuals' capacities for work;

- **Social capital**, that comprises the networks and organizations through which the contributions of individuals are mobilized and coordinated;

- **Natural capital**, that provides goods and services such as resources for production processes, absorption and recycling of wastes, water catchment and flow regulation or control of erosion processes. Natural capital can be further sud-divided into renewable natural capital and non-renewable natural capital.

Wealth creation is the process of using these four types of capital in combination to produce the flows of goods and services that people want/need. In order to sustain these flows of goods and services, and ensure their availability for future generations, it is necessary to maintain the level of capital stock. If the capital stock decreases, then it will not be possible to generate the same flow of goods and services. Therefore, maintenance of current capital stocks is a first condition for sustainability.

Weak and strong sustainability

If sustainability depends on the maintenance of the capital stock, then an important issue is whether it is the total stock of capital that must be maintained, with substitution allowed between the different capital forms, or whether certain components of capital, in particular natural capital, are non-substitutable, i.e. they contribute to welfare in a unique way that cannot be replicated by another capital stock (Ekins et al., 2003). This discussion has led to the definition of different degrees of sustainability, ranging from very weak sustainability, which assumes complete substitutability between the different capital stocks, to very strong, which assumes no substitutability, so that all natural capital must be conserved.

The following three degrees of sustainability can be distinguished (Costanza and Daly, 1992):

Weak sustainability is concerned with maintaining the total capital stock intact, without regard to the partitioning of that capital among the four kinds. This would imply that the various kinds of capital are more or less substitutable, at least within the boundaries of current levels of economic activity and resource endowment.

Strong sustainability calls for the maintenance of the separate capital stocks, assuming that natural and human-made capital are not perfect substitutes, but complementary. For proponents of strong sustainability, the substitutability of manufactured for natural capital is seriously limited by such characteristics of natural capital as irreversibility, uncertainty and the existence of ‘critical components of natural capital which make a unique contribution to welfare’ (Ekins et al, 2003; Daly 1991).

Absurdly strong sustainability, by which we would never deplete anything. Under this assumption, non-renewable resources could not be used, since their use would always mean decreasing capital stock and therefore would be unsustainable.

Several arguments have been raised within the ecological economics community in defence of the strong sustainability paradigm and calling for the maintenance of the natural capital stock, namely (Costanza and Daly, 1992; Ekins et al, 2003; Dietz and Neumayer, 2007):

- recognition of the impossibility of substituting for basic life support systems, namely the global environmental system that provides the basic functions of food, water, breathable air and a stable climate;

- acknowledgment that manufactured capital is, in the end, produced from natural resources with the help of human capital. This statement shows clearly that the two forms of capital are complementary rather than substitutes;

- irreversible character associated with the loss of certain components of natural capital (e.g. the extinction of a species), which generally does not happen in manufactured capital;

- acknowledgment of the risks, uncertainties and ignorance that surround our understanding of the functioning of ecological systems, meaning that we cannot tell what the effects associated with the loss of natural capital will be.

The concept of 'critical natural capital' has emerged in this context, as natural capital which is responsible for the important environmental functions and which cannot be substituted in the provision of these functions by manufactured capital (Ekins et al., 2003).

Sustainable management of natural capital

Adopting a strong sustainability standpoint, the following operational rules have been proposed to ensure sustainable management of natural capital stocks (Daly, 1991; Costanza and Daly, 1992):

1. The scale of human activities in the biosphere should be limited to a level that is within the carrying capacity of natural capital. Sustainability must deal with sufficiency, as well as efficiency, and cannot avoid limiting physical scale;

2. Technological development should focus on allowing for an increase in the efficiency of resource use rather than in increasing throughput (the flow of goods and services from natural to human systems and the associated flow of wastes from human to natural systems);

3. Renewable natural capital stocks, both in source and sink functions, should be managed on a sustainable basis, meaning that:

a. Harvesting rates should not exceed regeneration rates;

b. Waste emissions should not exceed the renewable assimilative capacity of the environment;

4. Non-renewable natural resources should be exploited no faster than the rate of creation of renewable substitutes. This is sometimes called El Serafy's rule (1991). The revenue from exhaustible resources such as oil is divided into two parts, one of which can be freely spent in consumption provided that the other part is invested into new sustainable sources of energy that will completely substitute for the depleted resources. This is in fact close to "weak sustainability" than to "strong sustainability" but then the question arises: should we leave oil in the ground instead.

References

Costanza, R., H. Daly, 1992. Natural capital and sustainable development. *Conservation Biology,* 6, 1, 37-46.

Daly, H., 1991. Elements of environmental macroeconomics. In Costanza, R. (edt) Ecological Economics: the Science and Management of Sustainability. Columbia University Press, New York.

Dietz, S., Neumayer, E., 2007. Weak and strong sustainability in the SEEA: Concepts and measurement. Ecological Economics, 61, 617-626.

Ekins, P., S. Simon, L. Deutsch, C. Folke, R. De Groot, 2003. A framework for the practical application of the concepts of critical natural capital and strong sustainability. *Ecological Economics*, 44, 165-185.

El Serafy, S., 1991. The Environment as Capital. In R. Costanza (edt) Ecological Economics: The Science and Management of Sustainability, New York, Columbia University Press, 168-175.

World Commission on Environment and Development, 1987. Our Common Future. Oxford University Press, Oxford.

81. Well Being

Use

The term well-being is most commonly used to describe what is ultimately good for a person. The question of what well-being consists of is of great importance for various disciplines, such as economics, philosophy and psychology. Well being is associated with two core notions - quality of life and happiness. Related are the concepts of freedom, human rights and social progress.

Evaluation

When evaluating the general well-being of individuals and societies, we usually refer to quality of life. It is used in a wide range of contexts, including the fields of international development, healthcare, and political science. Quality of life should not be confused with the concept of standard of living, which is based primarily on income. Instead, quality of life indicators include wealth and employment, and others pertaining to the built environment, physical and mental health, education, recreation and leisure time, and social belonging.

While quality of life has long been an explicit or implicit policy goal, adequate definition and measurement have been elusive. Diverse "objective" and "subjective" indicators across a range of disciplines and scales, and recent work on subjective well-being surveys and the psychology of happiness have spurred renewed interest. Regarding happiness, since it is subjective and hard to measure, other measures are generally given priority. It has also been shown that happiness, as much as it can be measured, does not necessarily increase correspondingly with the comfort that results from increasing income. As a result, standard of living should not be taken to be a measure of happiness.

In the 19th century, economists believed that happiness, which they called utility, could in principle be measured. By the 1950s, this view had been almost abandoned by neoclassical economists. However, in past decades, psychologists and a few economists have been studying peoples' feelings and investigating what makes them happy. The emerging insights are very important in relation to the study of the satisfaction of human needs and desires, but are still largely ignored in neoclassical economics. Several countries and International organizations are now questioning the divergence between economic growth and well-being improvements. Empirical studies have pointed out that income growth does not imply an increase in the quality of life and well-being enhancements. Economies are growing while social and income inequalities keep rising along with new poverties and social exclusions. As a result, social capital and cohesion are weakened with effects on crime, violence and life satisfaction.

Rethinking Growth and Well-being

These socio-economic phenomena call for a critical review of the nexus between economic growth and well-being. Does the GDP index tell us something about well-being measures? GDP does not include some positive components of well-being (social capital, social and cultural consumptions, etc.) but does account for components which have negative impacts on well-being (pollution, inequalities, etc.). As a consequence, economic indicators are poor measures of well-being. The need for a better evaluation of individual and collective well-being has shifted attention from GDP measures towards alternative measures both at macro (ex: Human Development Index, Index of Sustainable Economic Welfare, Genuine Progress Indicator) and micro levels – subjective measures of well-being.

Examples of new indicators of well-being:

- National Accounts of Well-being (New Economics Foundation) use comprehensive data from a survey of 22 European nations examining both personal and social well-being. Personal well-being describes people's experiences of their positive and negative emotions, satisfaction, vitality, resilience, self-esteem and sense of purpose and meaning. Social well-being is made up of two main components: supportive relationships, and feelings of trust and belonging.

- Human Well-being Index (Prescott-Allen, IUCN) is an attempt to overcome some of the limitations of GDP and the Human Development Index as measures of national wellbeing. Its main purpose is to form a component in a wellbeing indicator that addresses issues of sustainability and the "well-being" of the ecosystem. HWI is a composite of five domains: health and population; wealth; knowledge and culture; community; equity.

- The Happy Planet Index (New Economics Foundation) is designed to challenge well-established indices of national development, such as GDP and the HDI, which are seen as not taking sustainability into account. Each country's HPI value is a function of its average subjective life satisfaction, life expectancy at birth, and ecological footprint per capita.

Examples of programs integrating wellbeing:

- The Stiglitz report of 2009, which calls for measure of well-being alongside growth. This report adds to the literature on indicators of economic well-being and social progress and substantiates the voices of early pioneers like Hazel Henderson and Herman Daly. According to Stiglitz, *"GDP has increasingly become used as a measure of societal well-being and changes in the structure of the economy and our society have made it an increasingly poor one; many things that are important to individuals are not included in GDP."* The academics recommend including other factors, such as sustainability and education.

- Beyond GDP initiative (European Commission, European Parliament, Club of Rome, OECD and WWF), which work on improving measures of progress, wealth and well-being. In August 2009, the European Commission released its Communication "GDP and beyond: Measuring progress in a changing world". The Communication outlines an EU roadmap with five key actions to improve our indicators of progress in ways that meet citizens' concerns and make the most of new technical and political developments.

References:

Costanza, R. et. al. (2008) "An Integrative Approach to Quality of Life Measurement, Research and Policy". S.A.P.I.EN.S. 1 (1)

Layard R. (2005) Happiness: Lessons from a New Science. London. Penguin. April 2006. ISBN 978-0141016900.