ABSTRACT

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ECOLOGICAL DISTRIBUTION CONFLICTS AND INDICATORS OF SUSTAINABILITY

SOCIAL METABOLISM

Research on Material and Energy Flow Accounting, and also on the Human Appropriation of Net Primary Production (of biomass) (HANPP) has advanced somewhat. Statistical offices including Eurostat are now publishing statistics on Material Flows for European Union countries (1980-2000), with an agreed methodology that follows the principles developed through discussions between groups in Europe (mainly the Wuppertal Institut and the Sozial Oekologie group at the IFF, Viena). Neither Eurostat nor the European Environment Agency had initially any idea on how to proceed. The OECD is also sponsoring work on Material Flows and in general on physical indicators of (un)sustainability.

The HANPP is calculated in three steps. First, the potential net primary production (in the natural ecosystems of a given region or country), NPP, is calculated. Then we calculate the actual net primary production (normally, less than potential NPP, because of agricultural simplification, soil sealing etc.), and then we calculate which part of actual NPP is used by humans and associate beings (cattle, rats, etc.: this is the HANPP). In terrestrial ecosystems, the ratio between HANPP and potential NPP seems to be around 40% worldwide, but of course this is indeed a rough figure. The HANPP is meant to be an index of loss of biodiversity (because the higher the HANPP, the lower the biomass available for "wild" species), and this assumed relation is in itself a topic for research.

The relations between energy and the economy have been much discussed. There is research on the trend of EROI (energy return on energy input), that is the energy costs of obtaining energy (in different systems: wind energy, tar sands ...), and its implications for the economy. Thus, there are questions on the use in Europe of biomass energy when it comes from an agricultural systems that is perhaps increasingly inefficient in terms of energy. At world level there has *not* been a breakthrough in energy systems, all sources go up. Biomass energy at least doubled in the 20th century, coal increased six times, oil and gas increased many times more... Robert Ayres (the "father" of Industrial Ecology, based at INSEAD, France) has co-authored recent work showing a close long-run relation in the United States between growth of energy input in the economy (in terms of work done) and growth of GNP. Several groups are working on this topic in different European countries.

Still another idea for a single index of (un)sustainability, the "ecological footprint" (Rees and Wackernagel), survives as a didactic and political instrument, it has merit and success as a communication device, but we think it will not and should not make it to the level of official statistics because the "ecological footprint" contains information that largely duplicates the energy (food, biomass and fossil fuels) statistics, through it is presented in attractive spatial terms that explain its success. This discussion will be continued in the new scientific programme.

Trade and Material flows. Many years ago Patrick Geddes (1884) proposed the construction of a sort of input-output table inspired by the Tableau Economique of the Physiocrat François Quesnay. The first column would contain the sources of energy as well as the sources of materials which are used, not for their potential energy, but for their other properties. Energy and materials were tranformed into products through three stages, extraction, manufacture, transport and exchange. Estimates were needed of the losses (dissipation and disintegration) at each stage. The quantity of the final product (or "net" product, in Physiocratic terms) might seem surprisingly small in proportion to the gross quantity of potential product. Now, however, the losses at each stage were not accounted for in economic terms. The final product was not added value at all. It was the value remaining from the energy and materials available at the beginning once they had been through all three stages.

Geddes' scheme is relevant to the attempt by several authors today to develop a theory of ecologically unequal exchange between the metropolitan centres and the world peripheries. In neoclassical economics, provided that markets are competitive and ruled by supply and demand, there cannot be unequal exchange. This could only arise from monopoly or monopsony condictions, or because of non-internalized externalities (or excessive discounting of the future). In an ecological-economics theory of unequal exchange, one could say that the more of the original exergy [available energy or "productive potential" in the exported raw materials] has been dissipated in producing the final products or services (in the metropolis), the higher the prices of these products or services. This was indeed implied by Geddes with different words. Thus, Hornborg concludes, "market prices are the means by which world system centres extract exergy from the peripheries", sometimes helped, one must say, by military power. The European Union (15 countries) imports about four times more tons than it exports – environmental burdens are displaced elsewhere. Latin America exports six times more tons than it imports.

Water social-metabolism is in itself a topic for a programme. Water enters in social metabolism in an important way (100 times more in terms of weight than the MF). SOMEPROF will in principle leave water outside its scope because of financial constraints. On certain issues (such as waste into water, the energy and environmental impacts of new large desalination projects in Mediterranean Europe), SOMEPROF will necessarily deal also with water.

METABOLIC PROFILES

Metabolic profiles may be established (as regards Material Flows) for nations or regions, using the Eurostat methodology in order to ensure comparability with other similar analyses conducted for different countries. The research programme would include European regions and non-European countries. In this framework, a complete balance of an economy can be carried out by taking into account what crosses the system's boundaries. The net accumulation of materials in a system can be calculated as the difference between what enters (inputs) the system and what goes out (outputs). According to the Eurostat classification, material flows can be domestic, if extracted from the system, or ROW, if coming from the Rest Of the World. ROW material flows can be direct or indirect. The former enter directly into the system while the latter -the so-called "ecological rucksack"- are linked to the production of goods, even if these resources are later not exchanged in the market. In addition, both direct domestic and ROW material flows can be used and unused. The latter represent materials extracted or discarded during the production of a good, i.e. mining overburden, while the term used refers to an input for use in the economy.

Focus should be on direct material inputs, due to the fact that indirect flows increase the comprehensiveness of the analysis but they also increase its arbitrariness. This is because indirect flows are calculated by multiplying direct flows by standard coefficients. However, in reality they vary considerably depending on many factors, such as the state of technology and the economic conditions of a country. Moreover, if indirect flows are accounted for, comparisons between countries may imply double-counting internationally traded goods since indirect flows are accounted for twice –in both the exporting and the importing country.

It should be noted as well, that in the Material Flow Accounting water and air are excluded (although the water and air content present in materials are included). There is the concept of "virtual water" to describe the water content of production. It is too early still for statistical offices to include this in their accounts, but scientific research on methods of calculation must advance.

In the Eurostat methodological guide, material flows are classified into three main material groups (minerals, energy and biomass) and into three main categories (imports, exports and domestic extraction), which are used to structure the indicators calculated. (Fig. 1). Further subdivisions could be done so as to determine in more detail the Metabolic Profile of a country or region inside the country, and then try to link up such Metabolic Profiles to concrete environmental conflicts and remedial measures.

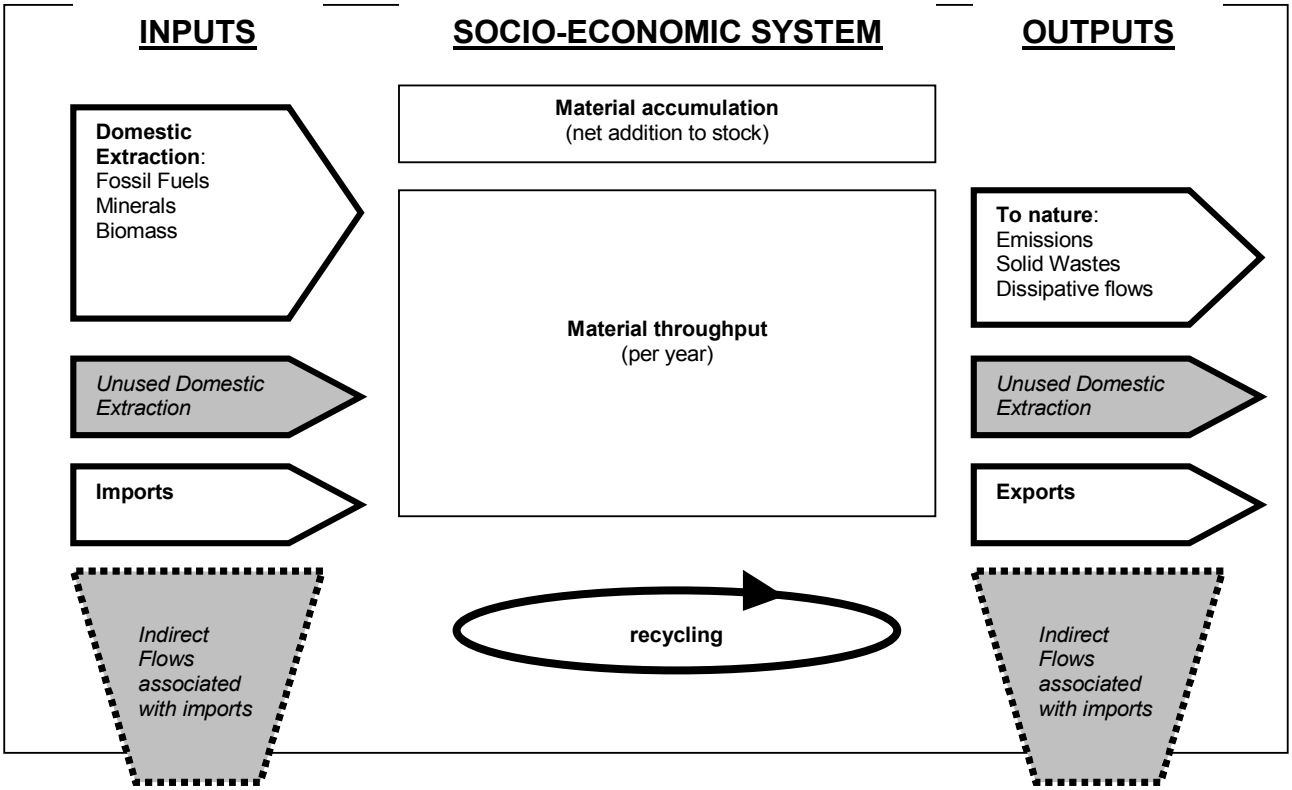
- Domestic Extraction: materials extracted in the national territory per year.
- Direct Material Input (DMI): Domestic Extraction (DE) plus Direct Material Imports (I) (DMI=DE+I).
- Domestic Material Consumption (DMC*):* DMI minus Direct Material Exports (E) (DMC=DMI-E=DE +I-E).

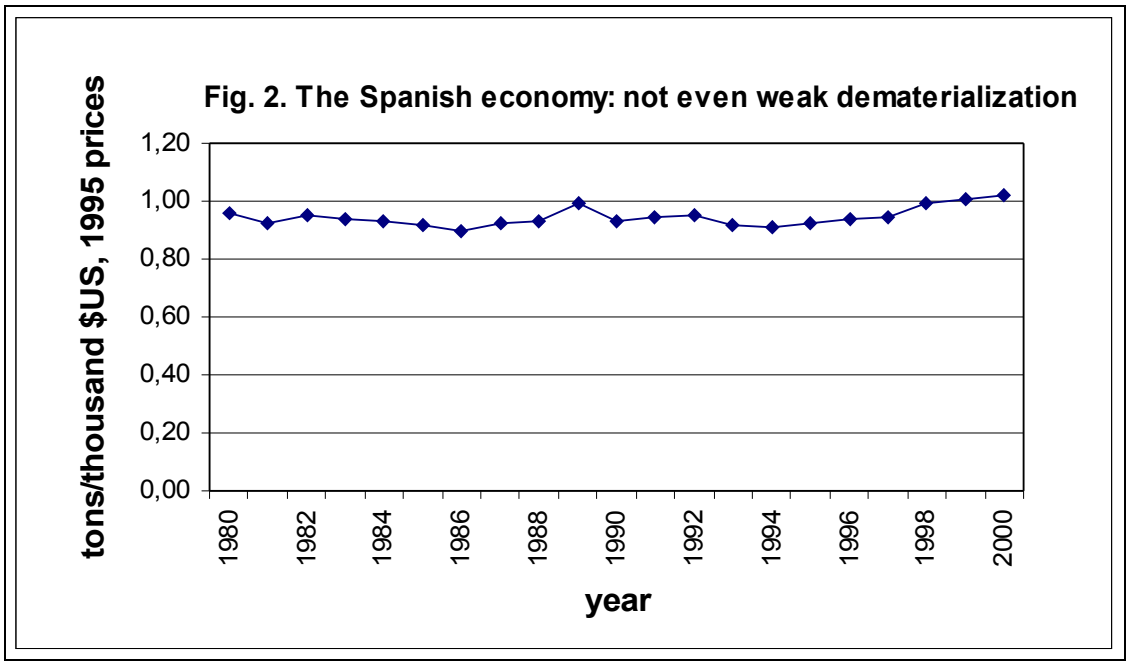
Taking, for instance, the MFA of the Spanish economy a number of conclusions concerning the relationship between the Spanish economy and its surrounding environment can be drawn. Firstly, the Spanish economy has shown no signs of dematerialization. On the contrary, the total mass of material moved by the Spanish economy (i.e. DMI = domestic extraction plus direct material imports) increased by 85% from 1980 to 2000, whereas GDP increased by 74%. Thus, Spain's trend towards convergence of income per capita within the European Union is matched by its "race to the top" in terms of materials.

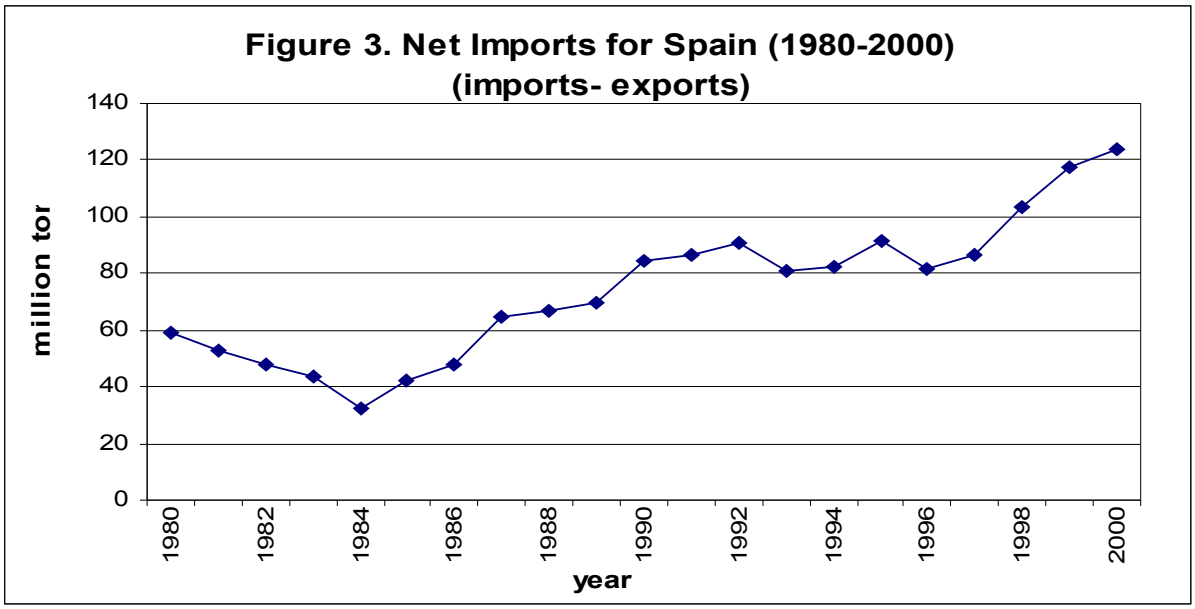
Secondly, in Spain domestic extraction (DE), consumption (DMC) and material input (DMI) in the economy has evolved in line with the economic cycles. Therefore, there is no evidence of a decoupling trend between economic growth and material use. The growth of building materials is comparatively remarkable as also the increase in energy materials (despite the decline of domestic coal extraction).

Thirdly, the Spanish economy has become increasingly dependent on international trade. Imports are twice as much as exports in terms of weight. In other words, Spain is using more and more natural resources from other economic systems to increase its welfare possibly displacing environmental loads to poorer countries. (Fig. 2 and 3). The dependence on energy imports has become a key characteristic of the Spanish economy. Also, metals that used to be domestically produced are now imported.

Figure 1. Economy-wide material balance (excluding air and water)







The increase in material flows reveals an increase in the consumption of internal and external resources, some of them causing high environmental impacts during extraction, transport, use or waste disposal. Thus, one may understand that in one country or region conflicts appear on the siting of quarries or on new transport infrastructures, while in other country or region conflicts arise on oil or gas extraction. Probably, the importance of the construction sector is reflected in the comparatively very rapid rates of *soil sealing* in some regions of Spain. Soil sealing (*Land Verbrauch*) is relevant for the calculation of HANPP. Thus, European data from different sources and collected for different purposes could be discussed in a common socio-metabolic framework

In other European countries there has been at least relative dematerialization. In this sense, the Spanish trend is typical of developing economies, it does not yet follow the performance of mature industrialised countries. Obviously, such research is of importance at world level given the fact that developing economies are getting locked into technological and consumption patterns similar to ours.

Political Ecology has been defined as the study of ecological distribution conflicts, i.e. conflicts on the access to natural resources and services and on the burdens of pollution. This article takes a broad globalized view of such conflicts. Many of these conflicts are outside the market. However, the prices in the economy depend very much on the outcomes of such conflicts. The following list of ecological distribution conflicts and related resistance movements was initially presented in Guha and Martinez-Alier (1997), as the evolving agenda of Political Ecology, and it is here expanded and rearranged.The names have been given by authors who have studied them, or have arisen from the world of NGO. Take a name like "biopiracy" - in a way, the fact is not new at all, it has been going on for 500 years; however, it is a new insulting name which reveals a sense of injustice, felt by some and denied by others.

A classification

Taking a socio-metabolic view of the economy, we can classify ecological distribution conflicts according to the different points in the "commodity chains" where they occur. It might be at the point

of extraction of materials and energy, or in manufacture and transport, or finally in the disposal of the waste.

Conflicts on the extraction of materials and energy

1.- Mining conflicts.Complaints over the siting of mines and smelters because of water and air pollution, and land occupation by open-cast mining and slag. Also, conflicts on oil and gas extraction. (Networks active in 2004: Mines, Minerals and People / Oilwatch).

2.- Biopiracy. The appropriation of genetic resources ("wild" or agricultural) without adequate payment or recognition of peasant or indigenous ownership over them (including the extreme case of the Human Genome project). This word was introduced by Pat Mooney, of RAFI, c. 1993.

3.- Land Degradation. Soil erosion caused by unequal distribution of land, or by pressure of production for exports. Blaikie and Brookfield (1987) introduced the basic distinction between pressure of population and pressure of production on the sustainable use of land.

4.- Plantations are not Forests. The movements against eucalyptus, pine, acacia plantations for wood or paper pulp production (often exported). (Carrere and Lohman, 1996).

5.- Mangroves vs shrimp. The movement to preserve the mangroves for livelihood, against the shrimp export industry, in Thailand, Honduras, Ecuador, India, Philippines, Sri Lanka...

6.- Water conflicts. Defence of the rivers: the movements against large dams for hydroelectricity or irrigation (such as the Narmada movement in India, the *atingidos por barragens* in Brazil). (Goldsmith and Hyldiard, 1986; McCully, 1996). Also, conflicts on the use and pollution of aquifers.

7.- National / local fishing rights. Attempts to stop open access depredation by imposing (since the 1940s in Peru, Ecuador, Chile) exclusive fishing areas (200 miles). The language here is international public law. Another conflicts is that of the defence (or introduction) of local communal fishing rights against industrial fishing (as in coastal India, or the lower Amazonia).

Conflicts on transport

8.- Transport conflicts are on the increase because of the larger and larger use of materials in the economy. Examples are complaints over oil spills from tankers or from pipelines, complaints over new motorways, harbours and airports, also over "hidrovías" (such as Paraguay-Paraná)...

Conflicts on waste and pollution

9.- Toxic struggles. This is the name given in the U.S. to fights against risks from heavy metals, dioxins, etc. Sources are Gibbs, 1981, Hofrichter, 1993.

10.- Waste dumping. The many conflicts around the world on waste dumps, incinerators. In an international context, "Toxic imperialism" was used by Greenpeace, 1988, to describe the dumping of toxic waste in poorer countries (theoretically forbidden by the Basle Convention of 1989).

11.- Transboundary pollution. Applied in the 1970s and 1980s mainly to sulfur dioxide crossing borders in Europe, and producing acid rain. Also between areas in the U.S. (New Englad polluted by western winds).

12.- Equal rights to carbon sinks.The proposal for equal per capita use of oceans, new vegetation, soils and atmosphere as sinks or temporary reservoirs for carbon dioxide (Agarwal and Narain, 1991). The disproportionate emissions of carbon dioxide have given rise to a "carbon debt".

13.- Consumers' and citizens' safety. Struggles over the definition and the burden of risks from new technologies (nuclear, GMO, etc.) in rich or in poor countries. (These are the conflicts of Beck's "risk society"). They also affect producers (agro-toxics). Such conflicts are not so new (asbestos, DDT...).

Vocabularies of conflict

The different ecological conflicts can be expressed in a variety of vocabularies. Very often around the world, fights against extraction of resources deploy the language of *Indigenous environmentalism*, that it, the use of territorial rights and ethnic resistance against the external exploitation of resources (e.g. Crees against Hydro Quebec, Ogoni and Ijaw against Shell). It might be that Convention 169 of ILO is used in such cases, or in India the protection of adivasi people in the Constitution and in the Samata vs Andhra Pradesh court sentence of 1997. Or, for instance, the pattern of trade consisting in specialization in the export of raw materials has given rise to the notion of *Ecologically Unequal Exchange*. This is defined as importing products from poor countries or regions, at prices which do not take into account the exhaustion of the resources and the local externalities. *Raubwirtschaft* means plunder economy, it was used by German and French geographers one hundred years ago. Ecological dumping means selling at prices which do not take into account exhaustion of resources or externalities, "dumping" in the context of international tarde means selling below cost. Ecological and economic dumping is a voluntary activity, it refers for instance to subsidized agricultural exports from U.S. and Europe. Instead, ecological unequal exchange arises because people in poor countries have no strength to internalize the negative externalities into the export prices, or to impose "natural capital depletion taxes". When exports of raw materials are produced by Transnational Corporations, there is often a demand for *Corporate Accountability*. This desire to make companies responsible for their acts and "environmental liabilities" is shown in the law suits against Texaco, Freeport McMoRan, Southern Peru Copper Corporation and many others in recent years in their country of origin, claiming damages for externalities caused in poor countries.

Waste disposal, and pollution threats have given rise to the language of *Environmental racism* in the United States, meaning the disproportionate burden of pollution in areas inhabited by African Americans, Latinos, Native Americans. *Environmental Justice* is the movement against environmental racism. Uncertainties on the causes of illness have given rise to movements for *popular epidemiology.* Environmental blackmail has been used to describe situations in which either LULU (locally unacceptable land use) is finally accepted, or the local population stays without jobs. (One well known source is Bullard, 1993). The notion of Environmental Justice is also used in South Africa (Bond, 2002), in Scotland (where poor communities are adversely affected by open cast coal mining or by waste dumps, like in Greengair, Dunion, 2003), or in Brasil.

The concept of the *Ecological Debt* is used in an international context. It brings together claims for a "carbon debt", i.e. damages from rich countries on account of past and present excessive emissions of

carbon dioxide, and claims because of biopiracy, and ecologically unequal exchange or plundering of natural resources.

Another term used in the context of international inequalities is that of *Environmental space* meaning the geographical space really occupied by an economy, taking into account imports of natural resources and disposal of emissions. *Ecological footprint* is a similar notion, i.e. the carrying capacity appropriated by large cities or countries measured in terms of space (Rees and Wackernagel, 1994). (The *ecological footprint* adds up food and other biomass, plus fossil fuels, plus the built environemnt, translating everything into space).

Finally, the opposition between *Ecological trespassers* and *Ecosystem peoples* signals the contrast between people living from their own resources, and people living from the resources of other territories and peoples. The idea comes from Dasman, it has been adapted by Gadgil and Guha (1995) internally to India, distinguishing between three categories of people: "omnivorous", "ecosystem peoples" and "ecological refugees".

The study of ecological conflicts make visible the environmental contents in social conflicts which were "disguised" under different headings. For instance, *workers' actions for occupational health and safety* are and have been struggles (in the framework of collective bargaining or outside it) to prevent damages to workers in mines, plantations or factories (they are, so to speak, "red" outside, and "green" inside).

Also, *urban activism for clean air and water, green spaces, cyclists and pedestrian rights* (Castells, 1983) are and have been struggles, outside the market, to improve environmental conditions of livelihood or to gain access to recreational amenities in urban contexts. Such actions are expressions of ecological distribution conflicts even though the actors (and their analysts) have not yet used an explicitly environmental vocabulary.

Ecological distribution conflicts might also give rise to what has been called *Social ecofeminism, or Environmental feminism* (Bina Agarwal, 1992), meaning the environmental activism of women, motivated by their social situation. The idiom of such struggles is not necessarily that of feminism and/or environmentalism. Finally, the *Environmentalism of the poor* describes social conflicts with an ecological content, today and in history, of the poor against the relatively rich, not only but mainly in rural conflicts (as explained in Guha's history of Chipko, 1989, and in Guha and Martinez-Alier, 1997).

Local and global

Some ecological conflicts in this list are local, and some are global. Some are fought in an explicitly environmental language, and some in other languages. One thing is clear - there are closer and closer connections between local conflicts and explicit, global environmentalism. Thus, the movements for the defense of mangroves in the Pacific Coast of Central and South America have pointed out to the role of mangroves as first coastline defence, increasingly important confronted with recurrent Niños plus the risk of greenhouse sea level rise. Local resistance movements reinforce the global networks, and in turn they profit sometimes by adding the language and the strength of global environmentalism to their own local idioms and forms of resistance. At other times, the conflict arises in the first instance because of the external global influence - witness the recent use of the language of biopiracy in conflicts over property rights on uña de gato, ayahuasca, sangre de drago, jacarandi, neem, and also quinua, basmati rice, turmeric, in several Latin American countries and in India.

Links are developing between local and global aspects of the disproportionate use of carbon sinks by rich people. For instance, Oilwatch groups around the world complain against local impacts, but they

also point out that more oil extraction means more carbon dioxide production. This network born from local conflicts between oil companies and local populations in the tropics has then learnt to use "greenhouse" arguments against oil extraction. Thus at Kyoto in 1997 OilWatch issued a carefully crafted Declaration eventually signed by over two hundred organizations from 52 countries calling for a moratorium on all new exploration for fossil fuel reserves in pristine and frontier areas, making the point that the burning of oil, gas, and coal is the primary cause of human-induced climate change, and that the burning of even a portion of known economically recoverable fossil fuel reserves would ensure "climate catastrophe". The evaluation of all power projects should involve consultation with the communities most affected by them, respecting their right to refuse projects - what would be constructed as a veto in multi-criteria analysis, similar to the endangered species provision in environmental management in the United States. Simultaneously, OilWatch demanded that oil, gas and coal prices "properly reflect the true costs of their extraction and consumption, including the best estimate of their role in causing climate change in order to apply the polluter pays principle to reflect the cost of carbon in the price". The Declaration also asked for full recognition of the ecological debt as it relates to the impacts of fossil fuel extraction, for a legally binding obligation to restore all areas affected by oil, gas, and coal exploration and exploitation by the corporations or public entities that are responsible, and that public investments (including World Bank funds) which presently go to subsidize fossil fuel extraction and consumption be used instead for clean, renewable and decentralized forms of energy with a particular focus on meeting the energy needs of the poorest 2 billion people.

The defence of indigenous groups against the oil or mining industries, or against large dams or logging, could be seen as part of a politics of identity, while the Environmental Justice movement in the United States insofar as it fights against "environmental racism", could also be seen in this light. However, the connections between local and global issues are obvious to the actors themselves. There exist international networks which grow out of local conflicts and which support them. Therefore, to see ecological distribution conflicts as a manifestation of the politics of identity would not be convincing. It is rather the other way around, the politics of identity being one of the idioms in which ecological distribution conflicts are expressed.

The relations between Political Economy and Ecological Economics

Ecological distribution conflicts arise because of the fact that economic growth, and population growth, lead towards increased use of materials and energy, and therefore towards larger production of waste. Because of unequal property rights, and social inequalities of power and income among humans (both international and internal to each state), the burdens of pollution and the access to natural resources are unequally distributed.

Ecological Economics studies the relations between the economy and the use of material and energy, in a socio-metabolic perspective. In order to do so, Ecological Economics resorts to many indicators and indices. We could consider Material and Energy Flows, and the Human Appropriation of Net Primary Production (HANPP). So, for instance, if the economy was becoming "dematerialized" in an absolute sense (and not only, as in some countries, relative to GNP), then many of the conflicts listed above would become less pervasive and intense. The European Union (15 countries) imports about four more tons than it exports – environmental burdens are displaced elsewhere. (Giuljum and Eisenmenger, 2004). Another instance of the link between indicators and conflicts: the appropriation of all the biomass of mangroves by the shrimp industry gives rise to social and environmental conflicts, this is also sometimes the case with the appropriation of the biomass in tree plantations for export as paper pulp. Thus, we could trace the relations between the Metabolic Profiles of different countries and the Environmental Conflicts that arise.

Ecological Economics is relevant for Political Ecology in a second way, namely, the conflicts regarding the use of the environment may be expressed in different languages of valuation. For instance, some actors might say that destruction of a mangrove or pollution of a river is after all an "externality" which can be made good and compensated by the economic value established in a fictitious market. Other actors will perhaps refuse such chrematistic language, and will appeal instead to the livelihood and rights of local peoples, or to the sacredness of nature, or to the equal dignity of all humans when confronted by "environmental racism", or to the ecological and esthetic values of the destroyed habitat and landscape. Who has the power to simplify complexity by imposing a single language of valuation? An Ecological Economics which is not money-reductionist but is open instead to value pluralism (perhaps operationalized through multi-criteria evaluation) will therefore will able to cooperate with Political Ecology in the analysis of ecological distribution conflicts.

There is still a third point of encounter betwen Ecological Economics and Political Ecology. The outcomes of ecological distribution conflicts might have a big influence on the paths towards sustainability. On the contrary, if claims for environmental justice are almost never successful, then a potential force for sustainability is being repressed.