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Introduction

Social Metabolism, Ecological Distribution Conflicts, and Valuation Languages

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This special issue brings together ecological economics and political ecological analyses to a greater extent than has been done before (M'Gonigle, 1999; Sneddon et al., 2006; Gerber et al., 2009). It sheds light on resource extraction and waste disposal conflicts in the context of a changing global social metabolism. By “social metabolism” we refer to the manner in which human societies organize their growing exchanges of energy and materials with the environment (Fischer-Kowalski, 1997; Martinez-Alier, 2009). Methodological tools and theoretical frameworks from the cross-disciplinary fields of ecological economics, industrial ecology, environmental sociology, ethno-ecology, social ecology, economic geography and political ecology are mobilized to explain socio-ecological dynamics and environmental conflicts in a range of case-studies from different parts of the world. In three cases the focus is on conflicts on the so-called extractive industries (mining and fossil fuels), in four cases on biomass conflicts, and in two on waste disposal conflicts.

A socio-metabolic perspective is adopted here which requires dealing not only with the extractive industries – mining for metals and building materials or extraction of fossil fuels (Canel et al., 2010) – but also with biomass extraction conflicts (tree plantations, e.g. Gerber, *in press*, agro-fuels and other export crops, deforestation and mangrove destruction, and fisheries). Biomass is extracted in non-sustainable ways. The HANPP (human appropriation of net primary production) is increasing in many areas of the world because of population growth or because of exports as our case-studies show. There is a new literature on the “embodied” HANPP (Haberl et al., 2009).

Research networks on mining, fossil fuels, wind and nuclear energy, water use, fishing, biofuels, tree plantations, land-grabbing, deforestation or mangroves destruction often communicate their findings separately with too little contact across different resource domains, and without bridges to the research on conflicts on transport and waste disposal. From the socio-metabolic perspective, we focus instead not only on mineral and biomass resource extraction but also on conflicts “at the end-of-the-pipe”, i.e. waste disposal (such as waste shipped overseas despite the Basel Treaty). This includes the carbon dioxide disposal conflict. There is a link (as the Yasuni ITT initiative in Ecuador makes clear, Martinez-Alier and Temper, 2007; Larrea and Warnars, 2009) between “leaving oil in the ground” and

the politics of the greenhouse effect because less fossil fuel extraction implies less carbon dioxide production. Connected conflicts arise at both ends of the economy, and also in the middle, e.g. conflicts on transport as those arising from oil spills from tankers, or from large infrastructures for commodity exports (for instance, the Porto Velho to Manaus road in the Amazon of Brazil).

A complete mapping of ecological distribution conflicts (a difficult undertaking since so many are not reported even in the local press) should certainly include also water use (dams, aquifers, interlinking of rivers, pollution, and the accounts of “virtual” water) and land use (urbanization, changing land-uses in the city and the countryside, “land-grabbing”, etc). There are no conflicts focusing on water and land use in this issue, more by accident than by design.

Most conflicts studied here have a rural setting at the frontiers of extraction but there is no lack of conflicts in urban areas as the Environmental Justice movement in the United States made it clear already in the 1980s (Agyeman et al., 2003). So, urban ecological distribution conflicts ought to be included in another special issue.

1. Commodity Chains

One starting premise of the research presented in this issue is the understanding that economic change generally occurs for the benefit of some groups and at the expense of others existing or future groups (Hornborg, 2009). Externalities may be understood as market failures but they may also be seen as (provisional) cost-shifting successes (Kapp, 1950). Optimistic views regarding ecological modernization, “dematerialization” of the economy, and the downward slope in the environmental Kuznets curves (Stern, 2004) are confronted with the reality of increased inputs of energy and materials into the world economy, and increasing production of waste.

The economy of rich countries or regions is so dependent from inputs of energy and materials that, even without economic growth, the pressure on the “commodity frontiers” (Moore, 2000) where these inputs are extracted from, is bound to grow. We know that energy cannot be recycled, and materials are recycled only to some extent. It is true that electricity produced in nuclear power stations or by windmills can be used at night to pump water up, and then produce some hydroelectricity during the day when demand is higher. Energy has been used twice. There are also enormous amounts of incoming solar energy that we must simply tap within agriculture and forestry or by other appropriate technologies. But in industrial economies whose main energy sources are the fossil fuels, the significance of the entropy law for the economic process (Georgescu-Roegen, 1971) is obvious.

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Once oil is burnt, it cannot be burnt again. Fresh supplies are needed. As we go down the Hubbert curve, extraction becomes ever more difficult and the EROI lower (Hall et al., 1986).

Resources essential to the metabolism of importing countries or regions (such as oil, gas, coal or some minerals and forms of biomass) are typically extracted at a heavy social and environmental cost. At other times, the materials extracted are luxury goods (diamonds, gold, mahogany, ivory or shrimp: “preciosities”, as Wallerstein, 1974, called them) that are important for the social relations and commercial economies of the importing countries though they barely appear in the statistics of imported material flows. However, their production or extraction can cause havoc in the exporting territories as it is known since the 16th century.

Inputs into the economy become ultimately outputs from the economy in the form of waste (except for the part that accumulates as a stock, like in buildings). The main output in volume from rich economies (apart from wastewater) is carbon dioxide from the burning of fossil fuels, the excessive production of which is a main source of climate change. Solid wastes produced by the economy are disposed off locally (in landfills or incinerators), or sometimes exported to distant regions or countries. All goods circulate through “commodity chains” (Raikes et al., 2000), i.e. from cradle to grave or from point of extraction to waste disposal. Ecological distribution conflicts occur at different stages as peasant or tribal groups, national or multinational companies, national governments, local or international NGOs, consumer groups, have stakes at different points of the chain.

Ecological distribution conflicts refer to struggles over the burdens of pollution or over the sacrifices made to extract resources, and they arise from inequalities of income and power (Martinez-Alier and O'Connor, 1996; Douguet et al., 2008; Roman, 2009). Sometimes the local actors claim redistributions, leading to conflicts, which are often part of, or lead to larger gender, class, caste and ethnic struggles (Agarwal, 1994; Robbins, 2004). In this line, the concept of “environmental justice” is important. It was born in the United States (Bullard, 1990) and it has gained growing acceptance in extractive industries, water use and waste disposal conflicts all over the world. Environmental justice not only refers to the distribution of costs and benefits but it also addresses participation and recognition claims (Schlosberg, 2007).

Moreover, the sexual division of work, power and access rights create different responsibilities and knowledge according to gender and make women and men perceive differently market intrusion and natural resources depletion, therefore creating mobilizations structured according to gender (Rocheleau et al., 1996). Important from this feminist perspective are the concepts of time, local economies, valuation and the institutions that govern access to resources. Mainstream economic thinking has neglected both women's work and ecosystem services (Perkins, 1997, 2007; O'Hara, 2009; Zein-Elabdin, 1996). When women mobilize against damaging activities and when they build up alternatives they also challenge patriarchy in their own culture, which often lead to an empowerment process.

While the study of the metabolism of economies (also described sometimes as Social Ecology) is shared by Ecological Economics with Industrial Ecology (and also with Agroecology and Urban Ecology), the study of ecological distribution conflicts belongs mainly to Political Ecology, a field developed by geographers (Blaikie and Brookfield, 1987), anthropologists and environmental sociologists (Robbins, 2004). Political Ecology focuses on the exercise of power in environmental conflicts, in other words, the question is: who has the power to impose decisions on resource extraction, land use, pollution levels, biodiversity loss, and more importantly, who has the power to determine the procedures to impose such decisions (Martinez-Alier, 2001a,b, 2002; Robbins, 2004)?¹

¹ The journal *Ecología Política* has been edited by Martinez-Alier in Barcelona since 1990.

Resources can be defended without an exclusive appeal to economic valuation, in a participatory multi-criteria framework (Munda, 2008). In this case, the languages of indigenous territorial rights, human rights (Sachs, 2003), livelihood, sacredness, environmental values, aesthetic values, and cultural values are allowed in decision-making, without being previously translated into a common monetized “bottom line” (Zografos and Martínez-Alier, 2009). Issues of valuation are central to both ecological economics and political ecology. In ecological economics, the incommensurability of values, participatory multi-criteria evaluation and deliberative evaluation methods (Zografos and Howarth, 2008) are the central topics of enquiry. Instead, commensuration imposes a common metric, as in cost-benefit analysis (Espeland and Stevens, 1998).

This special issue reports on some of the results of a multi-year research program concerning the study of social metabolism (material and energy flows), ecological distribution conflicts, and valuation languages, under the lead of Martínez-Alier² and much influenced by Munda's approach (Munda, 2008). The articles written by researchers from ICTA-UAB or other institutions for this issue are the result of close collaboration with local partners, research institutes and social movements involved in the conflicts studied.

2. The Articles in this Issue

The debate in the last twenty years on social metabolism and ecologically unequal exchange has Latin American roots (Muradian and Martínez-Alier, 2001; Muradian et al., 2002). Two pioneering authors were S. Bunker (1984, 1985, 2007) and A. Hornborg (1998, 2007), the first a sociologist, the second an anthropologist and a historian, both specialists on the Brazilian Amazon. This literature arose from the study of core-periphery relations, and now it is placed in the context of the analysis of “socio-ecological transitions” as developed by the Social Ecology group in Vienna (Fischer-Kowalski and Haberl, 2007; Krausmann et al., 2008, 2009), of interest not only to ecological economics and political ecology but also to economic geography.

The first article in this issue belongs to this line of research on ecologically unequal exchange. Maria Cristina Vallejo analyses the Material Flows in the economy of Ecuador over a 40 year period, and links this up with conflicts on resource extraction and debates on trade policy. Direct material flow indicators are used to characterize the ecological dimension of the economy of Ecuador. There has been a persistent net outflow of material resources (oil, bananas, and wood), the extraction of which causes environmental impacts and sometimes social conflicts. There are large socio-environmental liabilities left behind. This work by Vallejo continues other analyses of material flows (Perez Rincon, 2006; Gonzalez and Schandl, 2008; Russi et al., 2008; Muñoz et al., 2009). A related article (Vallejo et al., in press) studies the historical trajectory of material flows extraction for domestic consumption or export in Colombia, systematically coupling material flows with social conflicts, linking therefore ecological economics and industrial ecology with political economy.

The rest of the articles in this issue focus on particular cases of resource extraction or waste disposal through a diverse array of issues such as oil extraction in Peru, gold mining in Chile and Turkey, biofuels in Tamil Nadu, solid waste incineration in Campania, ship dismantling in Gujarat, logging in western Canada and south-eastern Cameroon, the soybean frontier in Paraguay and Argentina. In a cross-disciplinary spirit, a wide range of conceptual and methodological tools are employed, ranging from feminist ecological economics and political ecology, discourse analysis and post-normal science, to indigenous mapping, material flow analyses and social values surveys.

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The early contributions to feminist ecological economics (Waring, 1988; Nelson, 1997; Pietilä, 1997; Mellor, 1998) and feminist political ecology (Agarwal, 1992; Rocheleau et al., 1996) included research on provisioning, unpaid work and caring labour, non-monetized exchange relationships, and equity-enhancing political institutions, as well as activism-based theorizing (Perkins, 2007), but a focus on gender in resource extraction conflicts is still rare. The article by Sandra Veuthey and J.F. Gerber explores women-led resistance to commercial logging in Cameroon, focusing on the moabi tree (*Baillonella toxisperma*), an exported “preciosity” more than a bulk commodity. Resistance arises since the socio-environmental costs of this international logging trade are imposed on the rural populations and especially on women of the extractive regions. The local cultural and livelihood values of the moabi tree are not commensurable with the monetary export values.

The depletion of old-growth forests on Haida Gwaii (also known as Queen Charlotte Islands) in the western coast of Canada is a result of decades of excessive logging. It poses a looming threat not only to biodiversity and habitat values but also to the indigenous Haida culture, as Louise Takeda analysed in a doctoral thesis (University of Aalborg) supervised by Inge Ropke. The article brings into the analysis different conceptions of power in order to explain the explicit attempt made in this case to find a common language, that of a collaborative planning process to avoid deforestation. As so often happens in resource extraction conflicts at the commodity frontiers, the renewed identity of local indigenous groups played an important role.

Researchers, policy makers and civil society organizations discuss in India as elsewhere the potential of agro-fuels as partial substitutes for fossil fuels and thereby as a partial solution for climate change, and also rural poverty. An ambitious nationwide program for planting *Jatropha curcas* has been launched. Ariza-Montobbio and Lele studied the agronomic and economic viability and the livelihood impacts of *J. curcas* plantations on a sample of private farms in Tamil Nadu. On the whole, and contrary to the optimistic promises of the State and corporate promoters, the crop impoverishes farmers, particularly the poorer ones. The misguided promotion of *Jatropha*, the authors argue, endangers livelihoods and generates potential conflicts between the state and the farmers, between different socio-economic classes, and even within households. The water demands of the crop can potentially exacerbate the competition over scarce water access in Tamil Nadu villages. In this case, the authors warn of potential conflicts.

The soybean frontier for exports expands in various countries of South America. To explore some of the conflicts involved and the ways in which these are institutionally handled, Arizpe and Garcia-Lopez analyse two parallel participatory processes in Paraguay and northern Argentina. One of these processes, the Roundtable on Responsible Soy, was created by multinational firms (Monsanto) and international conservation NGOs with the support of the governments in the region, and it tried to establish criteria for “responsible soy production”. The other process is bottom-up, self-organized by peasant and civil society organizations, and focuses on stopping soy expansion and promoting “food sovereignty” and agrarian reform. The authors reveal the important differences of these two processes that might be missed under the blanket term “participation”, and argue that the latter process holds much more promise of managing conflicts productively and leading to sustainability. Here we notice how resistance breeds alternatives, both in practice and in conceptual terms. Via Campesina introduced the concept of “food sovereignty”, to which academics are trying now to give precise definitions and fill with analytic content.

Martí Orta and Matt Finer researched the social and environmental effects of oil extraction in the northern Amazon of Peru between 2005 and 2009. Orta cooperated with local federations of indigenous people in participatory action research (Orta Martínez et al., 2008). In their article they explain the forms of resistance developed over thirty

years by the Achuar of the Corrientes River against oil companies and against the Peruvian state, ranging from lobbying and writing memorials, to land titling and ethno-cartography, to roadblocks and the use of geographic information instruments (given to them by NGOs) in order to transmit information on oil spills, monitoring the environmental liabilities. They situate these events in the context of the current boom in oil exploration, with over one hundred thousand kilometres of seismic lines thrown throughout the Amazon territory in Peru where indigenous groups have long lived sustainably.

Gold mining projects are spreading in Latin America due to increasing international demand for gold and to the neoliberal reforms to facilitate foreign investment. In Latin America, the institution of local referendums on mining was born in the gold mining conflicts of Tambogrande (Muradian et al., 2003) and Esquel (Walter and Martínez-Alier, 2010). Two analyses of gold mining conflicts are included in this issue, one in Chile and one in Turkey. The conflict around the Pascua Lama project in Chile is a paradigmatic metal mining conflict. Starting with the defence of Andean glaciers endangered by the mine, local protests have been internationalized. Leire Urkidi's article, based on periods of intensive fieldwork, analyses the social background of different groups of stakeholders in the evolving conflict with Barrick Gold, the values and arguments articulated and the changing strategies that were developed. This agency analysis shows that this is not a case of environmentalism of the poor, even less of post-material environmentalism (Dunlap and York, 2008), but it can be characterized as what she calls a *glocal* environmental movement, transcending clear divides between local and global actors and action.

In Turkey, Duygu Avcı, Fikret Adaman and Begüm Özkaynak study the ongoing conflict over the prospect of gold mining at Mount Ida, unpacking the valuation languages used by social actors to either support or oppose gold mining. While this article is a fine study in environmental sociology, it clearly belongs also to ecological economics because of its emphasis on valuation. Based on in-depth interviews, focus groups and a large survey, the factors that determine positions on gold mining and the choice of valuation languages are examined. Assessing the conflict at Mount Ida in terms of valuation languages enables the authors to differentiate between disagreements that can be controlled via bargaining over the amount of monetary compensation and those that cannot. In comparison to Pascua Lama, the authors find expressions of valuation that conform with the environmentalism of the poor thesis (Guha and Martínez-Alier, 1997).

There are also two articles on waste disposal, completing the chain of social metabolism and the coverage of this Special Issue on the throughput of materials in the economy from cradle to grave. The article by Giacomo D'Alisa, David Burgalassi, Hali Healy and Mariana Walter deals with the sad situation in Southern Italy where in 2008, the Government issued a decree by which obstructions or protests in the vicinity of landfills or incinerators became a penal felony. This was the outcome of a process that began fifteen years earlier when regional waste treatment facilities were unable to cope with the waste accumulated in the region of Campania. This article studies the history of this conflict, drawing on a variety of sources including “activist knowledge” (Escobar, 2008), in order to identify a range of values and concerns about nature, health and democracy. The authors find that the decision-making process adopted by Italian governments oversimplified a complex crisis and obscured different emergent perspectives. As a result it increased social unrest by denying the will of a large part of the local population. To understand the conflict and evaluate the decision-making process, the authors use the notions of post-normal science and environmental justice.

The second article on waste disposal is written by Federico Demaria. More than 80% of international trade in goods by volume is carried by sea. The shipping industry constitutes a key element in the infrastructure of the world's social metabolism. Ship breaking is the

process of dismantling obsolete vessels, recycling to some extent the steel and other materials. The Alang-Sosiya shipbreaking yards in Gujarat, India, are the largest in the world. The economic crisis of 2008–09 increased the number of ships sent for dismantling. Demaria spent some months in Gujarat and Delhi in 2009, cooperating with the environmental organization Toxics Watch. The article describes the conditions of work in the Alang-Sosiya yards, and the environmental and health effects of shipbreaking. The controversy at the Supreme Court over the dismantling of the ocean liner “Blue Lady” shows the clash between different languages of valuation expressed by different social groups. In the Court’s decision we can follow the reasoning that leads to domination of monetary benefit at the national scale. Demaria’s article raises a further point. Many environmental conflicts end up in court; therefore, the analysis of deliberations on valuation by the courts is a good source for the research on ecological economics.

This Special Issue marks the evolution of an important line of research integrating ecological economics and political ecology for the study of environmental conflicts worldwide. This research will continue and expand with a large European project coordinated by ICTA-UAB (2011–14), called “Environmental Justice Organizations, Liabilities, and Trade (EJOLT)”, whose objective is to collect statistics and map environmental injustices worldwide, facilitating two-way communication between activism and science in the development and use of concepts such as the Ecological Debt and Ecologically Unequal Exchange (Robledo and Marcelo, 1992; Giljum and Eisenmenger, 2004; Simms, 2005; Robert and Parks, 2007; Rice, 2007; Hornborg and Jorgensen, 2010; Paredis et al., 2008; Srinivasan et al., 2008). EJOLT seeks to explain the causes of the increasing number of resources extraction and waste disposal conflicts in the world, and see whether and how they can be turned into a strong force for sustainability.

3. Conclusion: Combining Ecological Economics with Political Ecology

The planet is plundered because of economic growth, the search for profits, and the high levels of consumption of parts of the population under the present technologies. This has been coupled with nearly a fifth-fold increase in population since 1900. Population growth is fortunately now rapidly slowing down, and “peak population” will be reached probably by 2045 at less than 9 billion. Population might then decline a bit. Meanwhile, since the planet is limited in size, the frontiers of resource extraction and waste disposal are reaching the farthest corners. The movement to increase profits by expanding the frontiers of capitalism is resisted by a countermovement (as Karl Polanyi explained in *The Great Transformation* in 1944) to protect nature and humans. In the conflicts under discussion, the protagonists are not labour unions or nature conservation societies. They are EJOs (environmental justice organizations), indigenous groups, citizens and peasant groups, and women activists. They deploy their own values against the logic of profit making. At times, they mildly ask for monetary compensation for damages (“externalities”, in the language of economics), at times they demand respect for human rights to life and health, they insist on indigenous territorial rights, they claim that some mountains or some trees are sacred.

Industrialists and governments are worried by the strength of the environmental movement and particularly by the resistance from the environmental justice movements. They still defend strategies (that go back to Uslar Pietri’s 1936 recommendation in Venezuela of “sowing the oil”, *sembrar el petróleo*) based on “weak sustainability”, that is, money compensation for damages and substitution of the lost environment by manufactured capital. The economist Paul Collier (from the World Bank and Oxford University) is a new arrival to this tradition of thought (Collier, 2010). In Collier’s view, energy and material exports from the South should not slow down as long as local

inhabitants receive generous compensation for unavoidable environmental damage and receipts are invested in domestic development. He argues that the capacity to invest in the exporting countries or regions should be increased. Although Collier does not deny the existence of corruption and ill governance in the current squandering of revenues, he has no serious consideration for limits to growth or irreversible socio-ecological damages that can not be just compensated.

The case studies of this special issue, despite their variety in geographical setting, scale and methodology, share a common perspective which is different from Collier’s. They all explore the driving forces of the increasing number of ecological distribution conflicts, at different scales. They all attempt to link the increase in social metabolism with the growing number of such conflicts. The roots of the conflicts lie not only in failures of governance and in maladapted institutions, or in inadequate pricing but in the appetite of the world economy for inputs coming from the commodity frontiers, and the resulting export of waste from the metropolitan centres. The influence of world-system theory is obvious in our approach (Hornborg et al., 2007). As a collection, these studies show that the focus must be in a commodity chain perspective on “cradle to grave”, and sometimes also on “grave to cradle” as in conflicts on tree plantations for carbon dioxide capture (Lohman, 2006) or in the euphemism of waste incineration as “energy recovery”.

Authors in this issue insist on the fact that the conflicts arise not only from the driving forces of economic growth and the search for profits, and from the different interests and values of the stakeholders involved, but often also from the distribution of scientific and technical uncertainties and related risks. For instance, how do we evaluate the uncertain effects on health and the environment of dioxins and furans from waste incineration in Campania, from glyphosate aerial spraying in soybean cultivation in northern Argentina and Paraguay, from cyanide in gold production, or from heavy metals in ship dismantling and oil extraction? From the perspective of post-normal science so influential in ecological economics (Funtowicz and Ravetz, 1994; Pereira and Funtowicz, 2009), the uncertainties in such cases call for an “extended peer review”, i.e. participatory risk assessment by the affected populations and the activists on an equal footing with the officially certified experts.

Authors and editors share also (at least to some extent) the optimistic view that the social movements which coalesce around such conflicts are already now or might become in the future strong forces for environmental sustainability and social justice. However, the social composition of the main actors in the movements is indeed varied: indigenous federations in two of the cases, peasants and farmers in others, concerned citizens still in others. The two cases in India are about potential conflicts, it is not clear who the main actors will be, while women are active in many cases despite the usual participatory exclusions (Agarwal, 2001), and in one case (in Cameroon) they occupy the leadership position. We are far in this special issue from being able to answer the Marxian question, how can social class analysis and environmental politics be brought together.

The field of Political Ecology should not be divided into conflicts on extractive industries, conflicts on water use and land use, end-of-pipe conflicts on air pollution or solid waste disposal, and finally climate change or natural hazard conflicts, but it should keep a systemic perspective integrating methods for the study of social metabolism with methods for sociological and political analysis.

The environmental resistance movements have different protagonists, and social movement theory is useful to understand them. However, we are not interested so much in looking at such movements from a sociological classificatory perspective as in trying to see what their historical significance might be. What is their role in the necessary “socio-ecological transition” and in the development or recovery of social values and institutions appropriate for a sustainable economy?

Ecological economics and political ecology have much to offer combining the analysis of social metabolism and the analysis of procedural power in valuation processes, but such synergies had not been adequately explored to date. We identify here two main links between both fields of study. The first is that conflicts (studied mainly by Political Ecology) arise from the material metabolism of the economy (studied mainly by Ecological Economics, Industrial Ecology, and Social Ecology). Conflicts are certainly influenced by cultural perceptions of nature, and they are socially moulded. But there are material reasons (extraction of materials, disposal of waste) for their existence. Ecological Economics explain why environmental conflicts arise shedding light on the material origins of conflicts, whereas “post-structuralist political ecology” (Escobar, 1996) complements this with insights by looking at cultural discourses shaping material outcomes. In relation to this, a second link between Ecological Economics and Political Ecology is the analysis of the valuation languages (not only that of economic compensation) used by social actors in such ecological distribution conflicts. The languages must be allowed in their particular cultures. Thus, we cannot randomly declare “sacred” any landscape or building that we happen to like. A cultural agreement is needed.

The authors in this issue are indeed aware that in such conflicts several valuation languages are deployed, and they explicitly or implicitly ask the question, who has the power to simplify complexity and impose one particular language of valuation? This is a fundamental question for political ecology, and also for ecological economics. How to deal with value pluralism is something that conventional economists have been unable to resolve. Mellor (2006) highlights that the commodified market system forms a boundary between those things that are inside (and therefore generally valued) and those that are outside (and therefore generally valued) (cited in Perkins and Kuiper, 2005: 121). Indeed, until recently, standard economists did not take into account the impacts of human activity upon the natural environment nor the services provided by ecosystems which have remained “free subsidies” to the economy. Currently, the dominant utilitarian approach is to assign a single monetary standard of valuation – as it is the case in cost–benefit analysis or contingent valuation methods – in order to internalize and to trade off gains and losses of environmental change. The idea is to transfer market concepts to non-markets domains (Vatn, 2000). However, Spash (2000), Söderholm (2001) and others have pointed out that these methods often produce poor descriptions of the environmental values people actually hold. Monetary valuation is in itself controversial as it simplifies complex value systems related to environment (such as sacredness, livelihood, territorial rights, beauty, and biodiversity) and it is used by powerful groups in the society to reach their own interests. In the same vein, “prices” are often in themselves a tool of power through which the capitalist society imposes its own standard of valuation, thereby allowing to trade off economic benefits and socio-environmental costs in its own favour.

Most environmental conflicts fit into the same general pattern (Padel and Das, 2010). First, look at them as a product of the social metabolism (the throughput of energy and materials), with a variety of different consequences regarding health and environment. Second, look at the contested interpretations made of such consequences by industry and government experts, and by the populations affected, given the scientific uncertainties that may (or may not) exist in the case at hand. Third, classify the social actors involved, at different geographical scales (from a transnational company in Toronto or London to a tribe with a few thousand remaining members in a corner of the Amazon or India, and the other actors in between). Fourth, do the chronology of the conflicts, mapping the evolving positions of the social actors, as in a multi-criteria evaluation matrix. List all the valuation languages relevant and used by the social actors. Learn what they are saying even when this requires six months or one year of field work. Talk to women and men. Use the techniques of participant

observation and participatory action research. Read press reports, and try to get into companies' and governments' archives looking for internal documents. Apply, if you can, a formal MCE method that copes with incommensurable values, with quantitative and qualitative information, and explore whether there are “compromise” solutions, and the coalitions of social actors that would be behind such hypothetical solutions. Fifth, study the real decisions taken, imposing one or another outcome, analyse how the decision was taken, which valuation languages have been excluded, how power was exercised legally or illegally. Be ready to acknowledge and celebrate that in reality the economic language is not always triumphant.

References

- Agarwal, B., 1992. The gender and environment debate: lessons from India. *Fem. Stud.* 18(1), 119–58; also in R. Keil et al, eds., 1998, *Political Ecology*. Routledge, London.
- Agarwal, B., 1994. *A Field of One's Own: Gender and Land Rights in South Asia*. Cambridge U.P., Cambridge.
- Agarwal, B., 2001. Participatory exclusions, community forestry, and gender: an analysis for South Asia and a conceptual framework. *World Dev.* 29 (10), 1623–1648.
- Agyeman, J., Bullard, R., Evans, B. (Eds.), 2003. *Just Sustainabilities: Development in an Unequal World*. MIT Press, Cambridge.
- Blaikie, P., Brookfield, H., 1987. *Land Degradation and Society*. Methuen, London.
- Bullard, R., 1990. *Dumping in Dixie: Race, Class, and Environmental Quality*. Westview Press, Boulder, CO.
- Bunker, S., 1984. Modes of extraction, unequal exchange, and the progressive underdevelopment of an extreme periphery. *The Brazilian Amazon. Am. J. Sociol.* 89, 1017–1064.
- Bunker, S., 1985. *Underdeveloping the Amazon: Extraction, Unequal Exchange, and the Failure of the Modern State*. University of Chicago Press, Chicago.
- Bunker, S., 2007. The poverty of resource extraction. In: Hornborg, A., McNeil, J.R., Martinez-Alier, J. (Eds.), *Rethinking Environmental History: World-System History and Global Environmental Change*. Altamira Press, Lanham, pp. 239–258.
- Canel, E., Idemudia, U., North, L. (Eds.), 2010. *Canadian Journal of Development Studies*, 30 (1–2). Rethinking Extractive Industry, Special Issue.
- Collier, P., 2010. *The Plundered Planet. Why we must and how we can manage nature for global prosperity*. Oxford U.P., New York.
- Douguet, J.M., O'Connor, M., Noel, F., 2008. *Systèmes de valeurs et modes de régulation: vers une économie politique écologique*. Cahiers du C3ED, UVSQ.
- Dunlap, R.E., York, R., 2008. The globalization of environmental concern and the limits of the postmaterialist explanation: evidence from four cross-national surveys. *Soc. Quart.* 49, 529–563.
- Escobar, A., 1996. Constructing nature. *Elements of a post-structuralist political ecology*. *Futures* 28, 325–343.
- Escobar, A., 2008. *Territories of Difference: Place, Movements, Life, Redes*. Duke U.P., Durham.
- Espeland, W.N., Stevens, M.L., 1998. Commensuration as a social process. *Annual Review of Sociology* 24, 313–343.
- Fischer-Kowalski, M., 1997. Society's metabolism: on the childhood and adolescence of a rising conceptual star. Redclift, M., Woodgate, G., *The International Handbook of Environmental Sociology*. Edward Elgar, Cheltenham, In. pp. 119–37.
- Fischer-Kowalski, F., Haberl, H. (Eds.), 2007. *Socioecological transitions and global change. Trajectories of social metabolism and land use*. E. Elgar, Cheltenham.
- Funtowicz, S.O., Ravetz, J.R., 1994. The worth of a songbird: ecological economics as a post-normal science. *Ecol. Econ.* 10, 197–207.
- Georgescu-Roegen, N., 1971. *The Entropy Law and the Economic Process*. Harvard U. P., Cambridge.
- Gerber, J.F., in press. Conflicts over industrial tree plantations in the South. *Global Environmental Change*.
- Gerber, J.F., Veuthey, S., Martinez-Alier, J., 2009. Linking political ecology with ecological economics in tree plantation conflicts in Cameroon and Ecuador. *Ecol. Econ.* 68 (12), 2885–2889.
- Giljum, S., Eisenmenger, N., 2004. International trade and the distribution of environmental goods and burdens: a biophysical perspective. *J. Environ. Dev.* 13 (1), 73–100.
- Gonzalez, A.C., Schandl, H., 2008. The biophysical perspective of a middle income economy: material flows in Mexico. *Ecol. Econ.* 68 (1–2), 317–327.
- Guha, R., Martinez-Alier, J., 1997. *Varieties of Environmentalism: Essays North and South*. Earthscan, London.
- Haberl, H., Erb, K.H., Krausmann, F., Berez, S., Ludwig, N., Martinez-Alier, J., Musel, A., Schaffartzik, A., 2009. Using embodied HANPP to analyze teleconnections in the global land system: conceptual considerations. *Danish J. Geogr.* 109 (2), 119–130.
- Hall, C.A.S., Cleveland, C.J., Kaufmann, R., 1986. *Energy and Resource Quality: The Ecology of the Economic Process*. Wiley-Interscience, New York.
- Hornborg, A., 1998. Toward an ecological theory of unequal exchange: articulating world system theory and ecological economics. *Ecol. Econ.* 25 (1), 127–136.
- Hornborg, A., 2009. Zero-sum world: challenges in conceptualizing environmental load displacement and ecologically unequal exchange in the world system. *Int. J. Comp. Sociol.* 50 (3–4), 237–262.
- Hornborg, A., Jorgensen, A.K. (Eds.), 2010. *International Trade and Environmental Justice: Toward a Global Political Ecology*. Nova Science, Hauppauge NY.

- Hornborg, A., McNeill, J., Martínez-Alier, J. (Eds.), 2007. *Rethinking Environmental History: World-system History and Global Environmental Change*. Altamira Press, Lanham.
- Kapp, K.W., 1950. *The Social Costs of Private Enterprise*. Harvard U.P, Cambridge.
- Krausmann, F., Fischer-Kowalski, M., Schandl, H., Eisenmenger, N., 2008. The global socio-metabolic transition: past and present metabolic profiles and their future trajectories. *J. Ind. Ecol.* 12 (5–6), 637–657.
- Krausmann, F., Gingrich, S., Eisenmenger, N., Erb, K.H., Haberl, H., Fischer-Kowalski, M., 2009. Growth in global materials use, GDP and population during the 20th century. *Ecol. Econ.* 68 (10), 2696–2705.
- Larrea, C., Warnars, P., 2009. Ecuador's Yasuni-ITT Initiative: avoiding emissions by keeping petroleum underground. *Energy Sust. Dev.* 13, 219–223.
- Lohman, L., 2006. Carbon trading: a critical conversation on climate change, privatisation and power. *Dev. Dialogue* 48, Uppsala.
- M'Gonigle, M., 1999. Ecological economics and political ecology: towards a necessary synthesis. *Ecol. Econ.* 28 (1), 11–26.
- Martínez-Alier, J., 2001a. Mining conflicts, environmental justice, and valuation. *J. Hazard. Mater.* 86, 153–170.
- Martínez-Alier, J., 2001b. Ecological conflicts and valuation: mangroves vs. shrimp in the late 1990s. *Environ. Plann. C* 19, 713–728.
- Martínez-Alier, J., 2009. Social metabolism, ecological distribution conflicts, and languages of valuation. *Capitalism Nat. Socialism* 20 (1), 58–87.
- Martínez-Alier, J., 2002. *The environmentalism of the poor: a study of ecological conflicts and valuation*. Edward Elgar, Cheltenham. (Oxford University Press, Delhi, new introduction 2005).
- Martínez-Alier, J., O'Connor, M., 1996. Ecological and economic distribution conflicts. In: Costanza, R., Segura, O., Martínez-Alier, J. (Eds.), *Getting Down to Earth: Practical Applications of Ecological Economics*. Island Press, Washington, pp. 277–286.
- Martínez-Alier, J., Temper, L., 2007. Oil and climate change: voices from the south. *Economic and Political Weekly*, 15 Dec.
- Mellor, M., 1998. *Feminism and Ecology*. University Press, New York.
- Mellor, M., 2006. Ecofeminist political economy. *Int. J. Green Econ.* 1, 139–150.
- Moore, J.W., 2000. Sugar and the expansion of the early modern world-economy: commodity frontiers, ecological transformation, and industrialization. *Rev. Fernand Braudel Cent.* 23, 409–433.
- Munda, G., 2008. *Social Multi-Criteria Evaluation for a Sustainable Economy*. Springer-Verlag, Berlin-Heidelberg.
- Muñoz, P., Giljum, S., Roca, J., 2009. The raw material equivalents of international trade. Empirical evidence for Latin America. *J. Ind. Ecol.* 13 (6), 881–897.
- Muradian, R., Martínez-Alier, J., 2001. Trade and the environment from a "Southern" perspective. *Ecol. Econ.* 36, 281–297.
- Muradian, R., O'Connor, M., Martínez-Alier, J., 2002. Embodied pollution in trade: estimating the environmental load displacement of industrialized countries. *Ecol. Econ.* 41, 51–67.
- Muradian, R., Martínez Alier, J., Correa, H., 2003. International capital vs. local population: the environmental conflict of the Tambogrande mining project. *Peru. Soc. Nat. Resources* 16 (9), 775–792.
- Nelson, J.A., 1997. Feminism, ecology and the philosophy of economics. *Ecol. Econ.* 20 (2), 155–162.
- O'Hara, S., 2009. *Feminist Ecological Economics Theory and Practice*. In: Salleh, A. (Ed.), *Eco-Sufficiency and Global Justice*. Pluto Press, New York, pp. 152–175.
- Orta Martínez, M., Napolitano, D.A., MacLennan, G.J., O'Callaghan, C., Ciborowski, S., Fabregas, X., 2008. Impacts of petroleum activities for the Achuar people of the Peruvian Amazon: summary of existing evidence and research gaps. *Environmental Research Letters* 2(4), 045006, 10p.
- Padel, F., Das, S., 2010. *Out of this earth. East India Adivasis and the Aluminium Cartel*. Oriental Black Swan, New Delhi.
- Paredis, E., Goeminne, G., Vanhove, W., Maes, F., Lambrecht, J., 2008. *The Concept of Ecological Debt: Its Meaning and Applicability in International Policy*. Academia Press, Gent.
- Pereira, Á.G., Funtowicz, S., 2009. *Science for Policy: New Challenges, New Opportunities*. Oxford U. P, Delhi.
- Perez Rincon, M.A., 2006. Colombian international trade from a physical perspective: towards an ecological Prebisch thesis. *Ecol. Econ.* 59, 519–529.
- Perkins, E. (Ed.), 1997. Special issue on women, ecology, and economics. *Ecol. Econ.*, 20, pp. 105–185.
- Perkins, P.E., 2007. Feminist ecological economics and sustainability. *J. Bioeconomics* 9, 227–244.
- Perkins, E., Kuiper, E., 2005. Exploration: feminist ecological economics. *Fem. Econ.* 11, 107–150.
- Pietilä, H., 1997. The triangle of a human economy: household – cultivation – industrial production. An attempt at making visible the human economy in toto. *Ecol. Econ.* 20 (2), 113–127.
- Raikes, P., Jensen, M.F., Ponte, S., 2000. Global commodity chain analysis and the French filière approach: comparison and critique. *Econ. Soc.* 29 (3), 390–417.
- Rice, J., 2007. Ecological unequal exchange: international trade and uneven utilization of environmental space in the world system. *Soc. Forces* 85 (3), 1369–1392.
- Robbins, P., 2004. *Political Ecology*. Blackwell, Oxford.
- Robert, J.T., Parks, B.C., 2007. Fueling injustice: globalization, ecologically unequal exchange and climate change. *Globalizations* 4 (2), 193–210.
- Robledo, M.L., Marcelo, W., 1992. *Deuda Ecológica*. Instituto de Ecología Política, Santiago, Chile.
- Rocheleau, D., Thomas-Slayter, B., Wangari, E. (Eds.), 1996. *Feminist Political Ecology: Global Issues and Local Experiences*. Routledge, London.
- Roman, Ph., 2009. *Distribution écologique, distribution économique et soutenabilité. Une tentative de synthèse*, Master thesis, UVSQ, Versailles.
- Russi, D., Gonzalez, A.C., Silva-Macher, J.C., Giljum, S., Martínez-Alier, J., Vallejo, M.C., 2008. Material flows in Latin America: a comparative analysis of Chile, Ecuador, Mexico, and Peru, 1980–2000. *J. Ind. Ecol.* 12 (5–6), 704–720.
- Sachs, W., 2003. *Environment and human rights*. Wuppertal Institute for Climate, Environment, Energy, Wuppertal Papers No. 137, Wuppertal.
- Schlosberg, D., 2007. *Defining Environmental Justice: Theories, Movements, and Nature*. Oxford U. P, New York.
- Simms, A., 2005. *Ecological Debt*. Pluto Press, Ann Arbor, London, The health of the planet and the wealth of nations.
- Sneddon, C., Howarth, R.B., Norgaard, R.B., 2006. Sustainable Development in a Post-Brundtland World. *Ecol. Econ.* 57 (2), 253–268.
- Söderholm, P., 2001. *The Deliberative Approach in Environmental Valuation*. *J. Econ. Issues* XXXV (2), 487–495.
- Spash, C.L., 2000. Multiple value expression in contingent valuation: economics and ethics. *Environ. Sci. Technol.* 34 (8), 1433–1438.
- Srinivasan, U.T., Carey, S.P., Hallsteind, E., Higgins, P.A.T., Kerr, A.C., Koteen, L.E., Smith, A.B., Watson, R., Harte, J., Norgaard, R.B., 2008. The debt of nations and the distribution of ecological impacts from human activities. *Proc. Natl. Acad. Sci. USA* 105, 1773–1786.
- Stern, D., 2004. The rise and fall of the environmental Kuznets curve. *World Dev.* 32, 1419–1439.
- Vallejo, M.C., Pérez Rincón, M.A., Martínez-Alier, J., 2010. Metabolic profile of the Colombian economy from 1970 to 2007. *J. of Ind. Ecol.* in press.
- Vatn, A., 2000. The environment as a commodity. *Environ. Values* 9 (4), 493–509.
- Wallerstein, I., 1974. *The Modern World-system I*. Academic Press, New York, Capitalist agriculture and the origins of the European world-economy in the sixteenth century.
- Walter, M., Martínez-Alier, J., 2010. How to be heard when nobody wants to listen: the Esquel mining conflict. *Can. J. Dev. Stud.* 30 (1–2), 281–303.
- Waring, M., 1988. *If Women Counted: A New Feminist Economics*. Harper & Row, San Francisco.
- Zein-Elabdin, E., 1996. Development, gender and the environment: theoretical or contextual link? Toward an institutional analysis of gender. *J. Econ. Issues* 30, 926–946.
- Zografos, C., Howarth, R.B. (Eds.), 2008. *Deliberative Ecological Economics*. Oxford U.P, Delhi.
- Zografos, C., Martínez-Alier, J., 2009. The politics of landscape value: a case study of wind farm conflict in rural Catalonia. *Environ. Plann. A* 41 (7), 1726–1744.