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Global transformations and socio-environmental conflicts[1]

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Biographical notes

Dr. Roldan Muradian has a broad academic background and expertise, his research interests include, among others, the relationship between trade, development and the environment, water management in poor urban communities, payments for ecosystem services, governance issues of value chains, consumer behavior and factors determining cooperative performance (vertical and horizontal). He wrote this paper based at the Centre for International Development Issues Niimegen.

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Global transformations and socio-environmental conflicts

Roldan Muradian, Mariana Walter and Joan Martinez-Alier

Abstract

This paper argues that the emergence of new global economic centers is inducing a major expansion in the global social metabolism—the flows of energy and materials into the world economy —, a transformation in the systems for the extraction and provision of natural resources, as well as setting the conditions for socio-environmental conflicts at the commodity frontiers, particularly in areas with a dense human occupation of the territory. We point out that we are currently experiencing global transformations that constitute the beginning of a new historical phase of modern capitalism. The aim of the paper is to draw an overall picture of such transformations and discuss some of their implications for resource-rich countries.

Keywords

Social Metabolism, socio-environmental conflicts, resource-rich countries, hegemonic transitions

Contents

Introduction

In this paper we argue that we are currently experiencing global transformations that constitute the beginning of a new historical phase of modern capitalism. This phenomenon has significant socio-economic and environmental implications for countries rich in natural resources, particularly in Africa and Latin America. At the basis of such transformations is the recent economic emergence of China, and the hegemonic transition (*sensu* Arrighi) that this entails. The transition encompasses not only a shift in the geographical location of the economic cores of global capitalism, but also a major expansion in the metabolic profile — the flow of energy and materials— of the world economy and substantial changes in the global systems for the extraction and provision of natural resources. This has to do with the scale, the geography of extraction and consumption of resources, the dynamics of biophysical flows and the actors involved in the exploitation of both renewable and non-renewable resources at the global level. A rising global social metabolism is inducing the expansion of the extraction frontiers into new locations, and therefore setting the conditions for socio-environmental conflicts, particularly in places with fragile ecosystems and a dense human occupation.

The concept of social metabolism (Fischer-Kowalski and Haberl, 2007) refers to the physical throughput of the economic system, in terms of the energy and materials associated with economic activities, either as direct or indirect inputs or wastes. We consider it as a very appropriate conceptual tool for understanding the bio-physical size of the economy and therefore the contribution of economic processes to the consumption and depletion of natural resources. Its heuristic power is considerably enhanced when it is combined with the analysis of the political economy and ecology of resource extraction, use and disposal. Such combination (of insights from social metabolism and political ecology) enable us to establish linkages between the use of material and energy by some social actors and the environmental impacts experienced by others, often in geographically distant locations, and the resistance to these effects, which often take the form of socio-environmental conflicts. The main contribution of political ecology has been the analysis of conflicts that arise because of inequalities in power, property and income among human groups while they appropriate natural resources, ecosystem services or generate environmental impacts (Martínez-Alier, 2002). Socio-environmental conflicts are social mobilizations by actors that share a negative perception about environmental effects of particular economic activities. In section e we provide a more specific definition of socio-environmental conflicts. These conflicts might take place all along the different nodes of commodity chains, from extraction to final disposal, and by a single social group or a coalition of them, through social alliances and networks at different scales. The notion of “commodity frontier” (Moore, 2000) is an interesting metaphor to devote attention to the expansion of world capitalism in search of natural resources, and the implications of such expansion in terms of the division of labor, capital accumulation and environmental transformations. The concept also pays attention to the global economic processes that re-draw such frontiers, and therefore to global interdependencies. When we consider, for instance, communities in Peru affected by new mines, or mangroves (and human livelihoods) sacrificed in tropical coastal areas for the rising production of shrimps for exports, global interdependencies between resource use patterns in some world regions and socio-economic dynamics in the places of extraction become apparent.

In the present paper we discuss the features that make the current global transformations qualitatively different to the previous phase of capitalism development. We argue that there are at least four significant (inter-related) phenomena that are re-shaping the relationship between resource-rich countries and both the traditional and emerging cores of the world economy. In sections a to d we review each of these transformations. In section e we discuss some of the major implications of such processes for resource-rich countries, particularly in terms of the incidence of socio-environmental conflicts at the commodity frontiers.

a. A shift in the historical trend towards declining use of natural resources per unit of economic output

Even an industrial economy without growth would need "fresh" supplies of fossil fuels and other materials because energy is not recycled and materials can be recycled in practice only partially. Moreover, despite stagnation or slight decline in many OECD countries after 2008, the world economy is still growing at about 4 per cent per year in terms of global GDP, driven by the performance of the so-called emerging markets. The emergence of large Asian economies, and in particular China, as key players in the global economy might be conceived as a hegemonic transition in the world economy and politics (Arrighi and Silver, 2001), which is associated with the material expansion of global capitalism. At the core of the current global transformation in the use of natural resources there are three inter-related features of the Asian region, and China in particular: (a) a rising material intensity of the Asian economies (domestic material consumption per unit of GDP), particularly after 1990, while the rest of the world experienced a steady decline; (b) very high rates of economic growth; and (c) much higher growth rates of per capita use of natural resources, as compared to the rest of the world. As a consequence, in a matter of 40 years, the domestic material consumption has more than quadrupled in the Asian-Pacific region, while in the rest of the world it has increased only by about 50% (Schandl and West, 2010).

It is striking that despite considerable technological upgrading, the aggregate material intensity in the Asia-Pacific region has actually worsened during the past two decades, in sharp contrast with the trend in the rest of the world, which has experienced constant efficiency gains (Schandl and West, 2010). It is likely that this was caused by lower technological standards (in terms of resources use) by Asian firms. Paradoxically then, the shift towards Asia of the manufacturing industry — initially motivated by the search of economic efficiency derived from lower labor costs and huge potential domestic markets— has occurred at the expense of efficiency in the use of natural resources. When the process of global outsourcing of manufactures gained momentum (during the 1990s), considerations about resource efficiency did not have a large influence on decisions about the geographical allocation of economic processes, since prices of natural resources were at that time at a historical low level (which is not the case nowadays). The combination of high and rising material intensity and increasing per capita use of natural resources in the Asia-Pacific region is behind the shift (since about 2000) in the historical trend towards declining use of natural resources per unit of economic output at the global level. Such a trend reversion constitutes one of the particularities of the current phase of capitalism development.

b. New economic (and resource-consuming) centers of the world economy

Bruckner et al. (2012) uses the concept of embodied materials to report the substitution in industrialized countries — during the period 1995-2005 — of domestic material extraction by

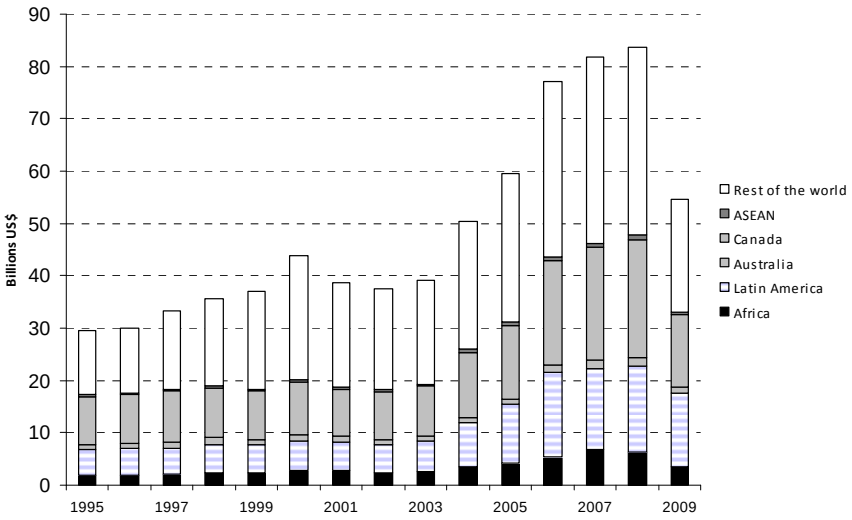
imports from other world regions. They argue that this trend is also shifting environmental burdens (and the associated socio-environmental conflicts) abroad. In addition to the level of wealth, population density is identified as an important factor explaining physical trade patterns. They show that European countries and Japan are particularly dependent (consumption of metal ores exceeding domestic supply by as much as 300%) on the direct and indirect (embodied) supply of materials from world regions richer in natural resources. In the paragraphs below we argue that China is following a similar pattern, increasing its dependency on resources from abroad, adding a huge demand for resources (to the already large demand from industrialized countries) but with the particularity of its vast size and lower resource efficiency, which makes it one of the most important new "centers" of global resource consumption. At the other extreme of the value chain, the exports of countries specialized in the provision of natural resources typically entail high level of embodied materials, pollution and energy per unit of economic output (Muradian et al., 2002; Tolmasquim and Machado, 2003; Muñoz et al., 2009), which underlies the relationship between the physical expansion of exports, environmental burdens and socio-environmental conflicts.

Figures 1 and 2 show changes across time of imports of non-renewable resources in the United States and China respectively. In a matter of less than two decades, China has shifted from being a rather negligible player to become the largest importer of non-renewable resources worldwide. This is a very remarkable transformation by all means. Canada, Australia, Latin America and Africa are accountable for most of the exports in this sector to both China and the United States. It is worth noting that the participation of Latin America and Africa in Chinese imports of non-renewable resources has increased considerably during the last decade. This has major implications for the distribution of wealth between world regions. Figure 3 depicts the ratio between American and Chinese imports of non-renewable resources and primary products as a whole. It shows a clear change of trend from the year 2.000, when China started to take over very rapidly as the emerging economic and resource-consuming center of the world economy. Nevertheless, per capita consumption of resources in China, and in Asia in general, is still far behind the U.S. and other high income countries in the West, though it is rising steadily and at a very high rate across time (Yellishetty et al., 2011). This gap in per capita resource consumption, and the comparative less efficient use of resources per unit of output in Asian economies, suggests that we can expect a rising demand for resources from Asia during the next decades, as far as the rates of economic growth in this part of the world remain high. From this point of view, it seems reasonable to forecast steady and rising demand for natural resources worldwide, driven by Asian consumption, unless these economies are hit by a severe economic crisis.

Compared to China, India's economy is less intensive in the use of resources, both in absolute and relative terms (per unit of GDP). Until the 1980s, the population in India grew at a slightly faster pace than material throughput. In the 1960s and 1970s, material use remained at a low level, namely less than 3 t/cap/yr. However, since the early 1980s a sustained growth in per capita material consumption set in, reaching the current 4.3 t/cap/yr (Singh et al., 2012). Notice that material consumption in European countries is about 15 t/cap/yr. In the 1960s, about three quarters of the total material consumption consisted of biomass, while construction materials were second in importance. Fossil fuels and industrial minerals and ores were insignificant in relation to the total flows. In the course of a 50 year period, this has changed considerably, in quantity and composition. The use of biomass only doubled. Fossil fuel consumption multiplied by a factor of 12, industrial minerals and ores by a factor of 8.6, and construction materials by a factor of 9 (Singh et al., 2012).

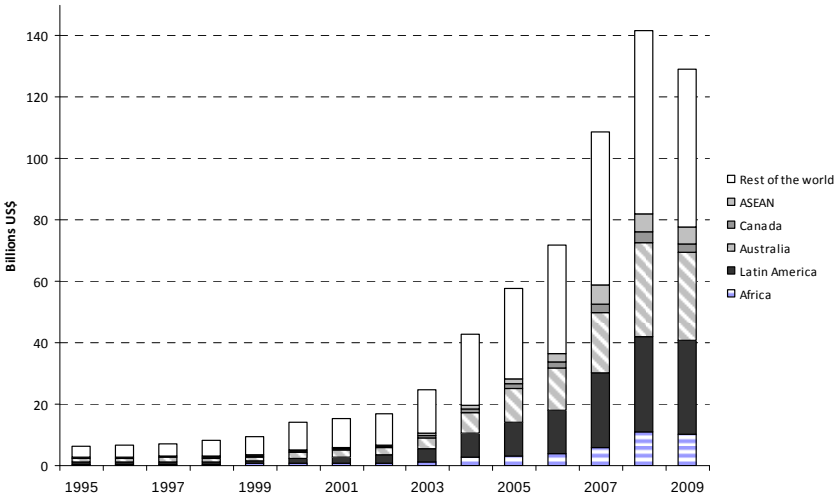
These are still modest figures compared to the Chinese transformations during the same period, but it is reasonable to expect that (if present rates of economic growth are maintained) India will increase its material throughput by at least a factor of three in the next 20 years (allowing for some increased efficiency but taking into account still some population growth). In Europe, imports exceed exports (in tons) by a factor of 4, and a similar situation is likely to occur in India (with exceptions such as iron ore, bauxite), due to its high population density, and the relative scarcity of resources in its territory. Such scenario will contribute to keep to the expansion of the commodity frontiers worldwide. So far, India has drawn however to a very large extent on internal supplies. Activists have reported an increasing number of resource extraction conflicts in some parts of India, often related to mining and hydroelectricity (Narain, 2008).

Figure 1. USA's Imports of Ores, Metals and Precious Stones



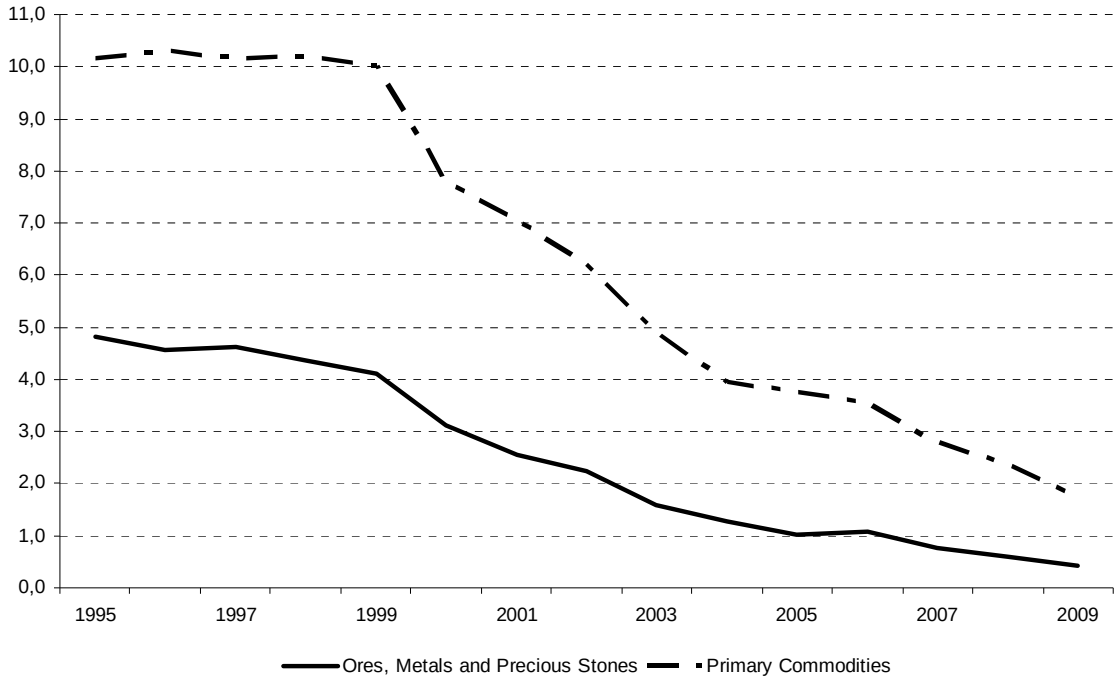
Source: UNCTAD-STAT

Figure 2. China's imports of ores, metals and precious stones



Source: UNCTAD-STAT

Figure 3. Ratio USA/China Imports (monetary)

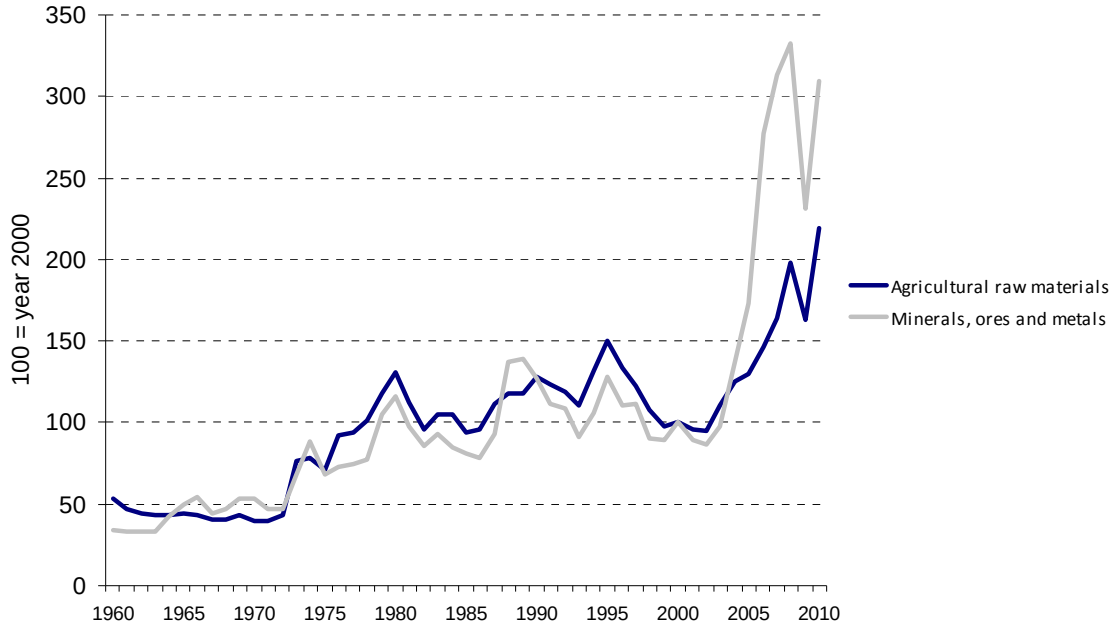


Source: UNCTAD-STAT

c. The paradox of relative scarcity in the middle of an extraction boom

In a matter of four years (2007-2011), the world economy has experienced two major food price spikes. These two extreme events are framed by what seems to be a shift from a lower to a higher price regime for natural resources, including food (Headey, 2011). The last equivalent price surge in the food sector occurred almost 40 years ago, in 1973-74 (Headey and Fan, 2008), which coincided with an oil crisis. There is no consensus about the drivers of the overshooting of food prices in 2008 and 2011. The phenomenon is likely to be the result of a combination of factors, such as changes in the composition of diets in Asia, dramatic rise in demand and perverse subsidies in the biofuel sector, a decline in the stock of grains in major Asian countries (as a policy strategy), trade restrictions, high inflation in the price of agricultural inputs, in addition to exchange rate movements and financial speculation (Gilbert, 2010; Timmer, 2010; Headey, 2011). The sharp increase in prices occurred not only in food products but in a wide range of commodities. Historically, the prices of renewable and non-renewable resources have followed very similar trends. Figure 4 shows the "mirror" behavior of changes in prices of food and non-renewable resources across time, and the "anomaly"—from a historical perspective— of recent spikes. The rise in the price of oil has a direct impact on the prices of agricultural commodities, due to the increase in the cost of agricultural inputs. Furthermore, in recent times, as we discuss below, inflation in the oil sector has also affected the demand for and price of biofuels, which in turn has induced a decline in the available land and agricultural production allocated to food consumption. In addition, underinvestment in agriculture —in part due to the adoption of structural adjustments and the associated dismantling of agriculture-support institutional setting in many developing countries during the 1990s— and mining (due to low prices) during the previous decades are in part responsible for the current relative undersupply (relative to the booming demand) of natural resources.

Figure 4. Commodity price index



Source: UNCTAD-STAT

While global reserves of most non-renewable resources are still far from reaching an extraction peak and current food production would be enough for feeding the world population, due to the combination of factors explained above we are currently experiencing an era of relative scarcity of natural resources (a regime characterized by high prices). Paradoxically, this coincides with a tremendous expansion in the production of natural resources. Global world production of iron ore, for instance, has more than doubled since the year 2000, and the exploitation of other minerals have followed a similar trend (Yellishetty et al., 2011). The combination of a rising pressure for exploitation, a decline in the quality of mineral reserves (Mason et al., 2011) and increasing competition among alternative land uses is driving the expansion of the extraction frontier into even more ecologically and socially vulnerable areas, often inhabited by indigenous people or historically disadvantaged social groups, and therefore setting the conditions for the emergence of new resource extraction conflicts.

Prior et al. (2012) addresses the specter of “peak metals” (the time at which extraction can no longer rise to meet the demand) in Australia, the major single supplier of non-renewable resources to the Asia-Pacific region, and China in particular. The authors argue that mineral resource depletion is as much about falling resource quality and accessibility as it is about a reduction in resource quantity and availability. They discuss the implications of expanding mineral exports in a context of declining ore quality, in terms of pollution and social costs, including land use and water use conflicts. Their enlightening insights can be applied to other world regions rich in natural resources.

d. Major changes in the global systems for the extraction and provision of natural resources

The emergence of huge Asian economies is redrawing South-South political and economic relations (Ellis, 2009; Fernández Jilberto and Hogenboom, 2007; Kaplinsky and Messner, 2008) and inducing the re-configuration of the systems for the extraction and provision of natural resources, with significant developmental and environmental implications (Gallagher and Porzecanski, 2008; Gallagher and Porzecanski, 2010; Jenkins et al., 2008; Ademola et al., 2009). We define such systems as the institutional and organizational settings that frame the way natural resources are accessed, exploited, processed, traded and consumed at the global level. This includes a number of dimensions, such as geopolitical relations, the agency of key players (states, firms, civil society organizations, communities), public and private regulatory frameworks, as well as physical and monetary trade patterns between world regions.

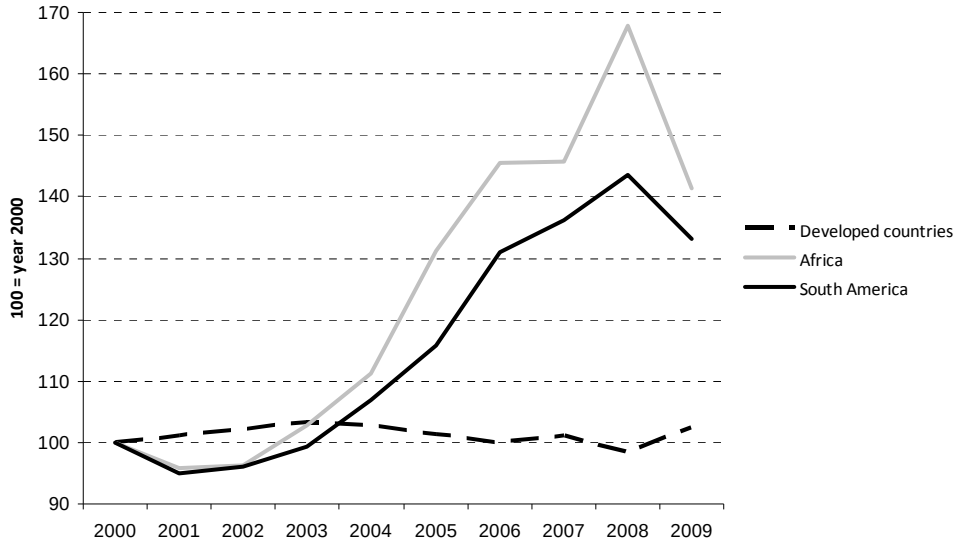
Structural changes in the way resources are appropriated by hegemonic powers are not at all new in the history of capitalism. For instance, the systems for the provision of natural resources to the metropolis during the colonial era were characterized by close ties between trade and financial flows, and a tight coordination between the state and private actors in the metropolis (Kaplinsky and Morris, 2009). After decolonization, many countries in the global South nationalized extractive industries. Nevertheless, during the 1980s and 1990s the systems for the extraction and provision of natural resources witnessed a new wave of re-configuration that favored Western transnational corporations, but in a context characterized by a de-linking of aid, trade and investment. The current re-configuration is yet to be fully understood, but interestingly — at least in parts of Africa— some of the emerging arrangements led by the Chinese state can be described as a "bundle" of Chinese aid, financial flows, international mobilization of labor, investment, infrastructure projects and trade (Bastholm and Kragelund, 2009; Kragelund, 2009; Esteban, 2009; Keenan, 2009; Tan-Mullins et at., 2010). Chinese foreign investment has been concentrated so far in the primary sector, and it has been characterized by a high level of state leverage. One of the key features of the current reconfiguration is the emergence of new powerful players in the value chains of natural resources, namely Chinese transnational corporations dealing with extraction and trade activities. A particularity of the new situation is that these firms are mostly state-owned, while the translational corporations that dominated value chains in the previous phase were mainly private. This fact has considerable implications, since the global expansion of these firms is the result of a combination of centrally planned state decisions and market forces, framed by close coordination between the state and firms, particularly between international policies of the Chinese state (such as foreign aid), the provision of capital (often through state-owned banks such as the China Development Bank and The Export and Import Bank of China) and the action of Chinese firms.

On one hand, the situation described above is reminiscent (apart from the significant differences in the scale of energy and material flows) to the relationship between the metropolis and the places of resources extraction during the colonial regime (Jenkins et al., 2008). On the other hand, the new regime of high prices of natural resources is inducing high rates of economic growth (and imports from China) in resource-rich countries. The latter suggests mutually "re-enforcing" positive economic cycles between China and its "peripheries". Actually, as it might be seen in Figure 5, during the last decade there has been a radical shift in the terms of trade of Latin American and African countries (typically specialized in the provision of natural resources to the world economy). Contrary to the

Prebisch-Singer hypothesis of a secular downward trend in the price of natural resources (Harvey et al., 2010), since 2000 the terms of trade have improved for the resource exporting countries (although one could argue that high export prices hide negative externalities unaccounted for). Such trend shift has been possible due to a combination of high commodity prices and a considerable decline in the price of manufactured products, due to the enormous supply capacity of China and other large Asian countries in the manufacturing sector (enabled by cheap labor and large foreign direct investment in China). From a historical perspective, it would perhaps be the first time that the emergence of a new hegemon of global capitalism is associated with very favorable conditions for the peripheries that play the role of suppliers of natural resources. In the past, access by dominant powers to natural resources in peripheral areas of the world economy have been characterized by either regimes of direct appropriation of territories (British or Spanish empires) or indirect domination by corporations (American- or Dutch-dominated world capitalism), both with —in general— unfavorable consequences for resource-rich countries.

Summarizing, with regards to patterns of changes in social metabolism and the global search for natural resources, the emergence of China is similar to the path followed by the rise of previous hegemonic powers in the West and more recently by other economies in Asia, such as Japan and Korea. However, some of the most important particularities of the current Chinese ascent are the following: (a) the scale: the population size of China magnifies the global effects of changes in internal resource consumption; (b) a higher level of global awareness and mobilization about the negative environmental effects associated with rising resource consumption. Previous hegemonic powers were able to expand their global access to natural resources without major contestations to their environmental performance (Mol, 2011); (c) favorable terms of trade for the suppliers of natural resources, which is the result of a combination of factors. Namely, a huge demand (due to the large and rapidly rising scale of the Chinese economy), a relative scarcity of natural resources (in part due to lower quality of reserves as compared to previous phases) and a tremendous supply capacity of manufactures from China (which makes prices of manufactured products relatively cheaper).

Figure 5. Terms of Trade Index



Source: UNCTAD-STAT

One of the main implications of the recent shifts in the terms of trade of resource-rich countries is the de-linking of emerging markets from previous economic cores. While the U.S., Europe and Japan are coping with heavy debt burdens and prolonged economic stagnation, Latin American and African countries have been able to remain in a phase of high economic growth, with a brief halt in 2009, after a decade of strong economic expansion. Such de-linking between traditional cores of the world economy and their "peripheries" have been possible only due to the Asian demand for natural resources, which so far has been resilient to recent global economic instabilities.

Though a regime of high prices of commodities is in general favorable for the economic growth of resource-rich countries, the emerging systems for the extraction and provision of natural resources combine different modalities for ensuring access to resources, including some that are less likely to generate positive impacts in the exporting countries, such as the previously mentioned state-backed expansion of Chinese corporations in Africa and worldwide large-scale land acquisition by Chinese (Hofman and Ho, 2011) and other major players. Land grabbing at a very large scale by state or private agents is another of the unique features of the emerging global regime for the exploitation and provision of natural resources (Borras et al., 2011; Deininger et al., 2011). Scheidel and Sorman (2012) use insights from the energetic analysis of economic systems (a tradition to which, among others, N. Georgescu-Roegen, R. U. Ayres and M. Giampietro belong) providing an interesting conceptual framework to relate current changes in the energy profile of the world economy and the dramatic rise in large-scale land acquisitions worldwide. They propose that the area needed for alternative energy sources is expected to increase dramatically, instigating land grabs for energy security, and therefore clashes with the expanding production of renewable resources. The shift of land use from food production to agro-fuels is one of the major current agrarian transformations (Borras and Franco, 2012), associated not only with large-scale foreign land acquisitions, but also with processes of local land re-accumulation by national landholders. The emergence of the bio-energy industry has created new linkages between the price of oil and incentives for investment in land acquisition. Such new enthusiasm for land is likely to exacerbate the perception of relative land scarcity and therefore to be related to present and future land access struggles by different social groups, as well as to the expansion of the agricultural frontier into natural ecosystems. The area dedicated to oil palm cultivation has tripled since 1990, and this remarkable expansion is considered the "greatest immediate threat to biodiversity in Southeast Asia" (Wilcove and Koh, 2010). In countries such as Colombia, Indonesia or Malaysia, just to mention a few, the expansion of oil palm cultivation often takes place into areas previously covered by either natural ecosystems or traditional mono-crops, such as banana, setting the conditions for different types of conflicts and social resistance (Suyanto, 2007; Butler and Laurance, 2010; Pye, 2010; Rist et al., 2010).

e. Implications for resource-rich countries

The processes explained above entail both opportunities and threats for resource-rich countries. Closing the income gap between poorer resource-rich countries and industrialized countries might create many opportunities for a better distribution of wealth at the global and national levels, and for reducing poverty worldwide. High prices of natural resources in principle should favor the bargaining power of states to set the conditions of extraction of natural resources, including the distribution of benefits, and the prevention, compensation for and remediation of environmental damages. Indeed, many governments in Latin America, such as Brazil, Bolivia, Argentina and Ecuador, for example, have taken advantage of the new situation to negotiate successfully a much

larger share of the economic rents derived from the exploitation of natural resources. However, the current strong incentives for primary specialization (particularly the combination of high commodity prices and harsh competition with cheap manufactures from China) will induce further primary specialization in resource-rich countries and therefore a much higher dependency on exports of natural resources. The long-term negative effects of primary specialization have been well identified in the literature on development economics long ago, including the risks of Dutch disease (as in the appreciation of the Real in Brazil, which facilitates industrial imports against its own industry), volatility in the rates of economic growth, high vulnerability to the international prices of commodities, the risk of "enclave" growth (with a large proportion of the population excluded from its benefits), and rent-seeking behavior by the state and firms (Muradian, 2010). Nowadays, we could add the threats associated with high inflation of food, which affects seriously the urban and rural poor, and the incidence of processes of exclusion due to large-scale land accumulation by few local or foreign agents.

The new situation (the emerging relationship between the economic development of China and resource-rich countries) seems to be vulnerable and unstable, since it is steering high rates of economic growth, but also it is inducing lower levels of resilience in emerging markets (due to over-specialization in the provision of natural resources). Resource-rich countries are de-linking their economic development path from the industrialized countries, but at the same time they are becoming very dependent on the performance of the Asian drivers, and more specifically China. Overspecialization on the primary sector is increasing significantly the economic vulnerability of resource-rich countries, particularly the small ones. An economic downturn in China will be reflected rapidly in much lower rates of economic growth in resource-rich countries. A very relevant question is then to what extent the high rates of economic growth in China, and India for that matter, can be sustained in a context of crisis in the old economic cores and high prices of natural resources. The two most likely scenarios are either: (a) A long cycle of mutually re-enforcing economic growth between the Asian drivers and resource-rich countries, which will constitute a new phase of modern capitalism, characterized by a hegemonic transition associated with the economic upgrade of peripheral (resource-rich) regions or (b) A second systemic collapse (a global economic and financial crisis spreading to China), this time affecting heavily also the emerging markets (peripheral countries). Which scenario is realized will depend on the capacity of giant Asian economies to grow in a context of high prices of raw materials, which is still uncertain.

Socio-environmental conflicts

One of the main effects we could expect from the current regime of high prices and relative scarcity of natural resources is an increase in competition for access to resources and hence in the probability of conflicts related to the distribution of economic and environmental costs and benefits of resource exploitation, particularly at the commodity frontiers. While high prices could favor revenue redistribution to local stakeholders, the increase in the extraction effort at the "commodity frontiers" likely set the conditions for new socio-environmental conflicts. We define socio-environmental conflicts as mobilizations by social movements against particular economic activities, in which concerns about current or future negative environmental impacts are an important part of the grievances. We refer to conflicts in which contestation by social groups is visible, either through legal cases, campaigning, demonstrations or direct (even violent) confrontations. When minimum freedoms are lacking and fear, internal colonialism and social subordination prevail, open conflicts

remain latent, since agents might adopt hidden forms of resistance (Scott, 1990). At other times, the agents of violent conflicts are not those directly damaged in their livelihood by resource extraction but armed groups aiming to gain access to natural resources, such as for instance a rebel group fighting to control a diamond mine. By focusing on threatened livelihoods we therefore deal with a field of conflict analysis that is different from the one addressed in the literature tackling the relationship between natural resources and the incidence of civil wars and other armed conflicts, particularly in Africa (Collier and Hoeffler, 2005; Collier, 2010). Contrary to rebels aiming to reap the rents from the extraction of natural resources, in a considerably proportion of socio-environmental conflicts social movements actually resist the expansion of the extraction frontiers, often as a strategy to defend a particular rural livelihood.

Though socio-environmental conflicts are usually intertwined with grievances about access to resources or the distribution of economic rents derived from their exploitation, a distinctive feature of this type of conflicts is that they constitute a form of resistance, and use as language of contestation either with explicit reference to environmental claims, appealing to the dependency of local livelihoods on the threatened resources, or making use of religious/worldview concerns for defending natural ecosystems or the right to a clean environment. Indigenous or not, agents engaged in socio-environmental conflicts often appeal to territorial rights. Regularly, social groups also protest against decision-making procedures that exclude or minimize their claims and concerns. Furthermore, social movements involved in this kind of conflicts are typically organized in networks and coalitions across several scales. Inter and intra scale networks are not always in place when conflicts start, but they are usually configured when conflicts unfold and evolve. It is common to see local peasant groups or indigenous communities working jointly with urban environmental NGOs that are part of international networks or campaigns of the global environmental justice movement (e.g. International “No dirty gold” campaign).

There is much new research on socio-environmental conflicts around extractive activities (Bebbington et. al. 2008; Avci et al., 2010; Svampa and Antonelli, 2009; Walter and Martinez-Alier, 2010; Urkidi, 2010), oil extraction (Stetson, 2012) deforestation (Veuthey and Gerber, 2011) and the distribution of agricultural land and access to fish, forest products and other biomass resources (Haller and Merten, 2008; Xuan Phuc, 2009). Many of these conflicts occur at the “commodity frontiers” (Moore, 2000; 2003), where environmental justice movements struggle to protect their livelihoods and environments. Though they are concentrated in the extraction phase, socio-environmental conflicts also occur all along the commodity chain (Martinez Alier et al., 2010), including transport and infrastructures (e.g. oil spills, pipelines, harbors, dams), processing (e.g. industrial pollution) and final disposal (e.g. landfills). The latter includes urban and industrial wastes, CO_2 emissions or overseas disposal of hardly reusable materials, as in ship-breaking yards in India and Bangladesh (Demaria, 2010).

As we have pointed out in previous sections of this article, there is evidence of an increase in the extraction intensity in the global south. Studies dealing with social metabolism indicators, such as Material Flow Accounts (MFA) -that quantify in physical terms the flow of materials and energy in and out an economy yearly- have been recently conducted in Latin American countries such as Argentina, Chile, Peru, Mexico, Ecuador, Colombia and Brazil. They indicate a sharp increase in the intensity of resource extraction since the mid-1990s (Eisenmenger et al., 2007; Giljum, 2004; Russi et. al., 2008; Gonzalez-Martinez and Schandl, 2008; Vallejo, 2010; Vallejo et. al. 2011; Perez Manrique et al., 2011). Some studies have also discussed the relations between these extraction

trends and the occurrence of socio-environmental conflicts (Martinez-Alier et al., 2010; Vallejo, 2010; Vallejo et al., 2011).

Social movements are reacting with new strategies and tools to this extraction intensification. For instance, since the early 2000s, social movements worldwide are creating online databases that systematically register information on ongoing socio-environmental conflicts. More recently, universities and research projects have also engaged in similar initiatives. For instance, Gerber (2011), drawing on the "activist knowledge" of the international network WRM (World Rainforest Movement), classified and analyzed over 50 conflicts on tree plantations (such as eucalyptus) worldwide. There are databases recording a wide range of socio-environmental conflicts at different scales, like the Environmental Justice and Health database of Brazil (FIOCRUZ) with a national reach; the Latin American Observatory of Environmental Conflicts (OLCA), the Database of Social Conflict in Africa (SCAD) with a regional focus; the Environmental Conflicts Documentation Centre (CDCA), or the EJOLT database project with an international scope (Martinez Alier et al. 2011). Some databases focus on specific issues, such as tree plantations (e.g. WRM- World Rainforest Movement), land grabbing (GRAIN) and mining (MAC- Mines and Communities). For instance, the Latin American Observatory of Mining Conflicts, reports 155 ongoing mining conflicts affecting 205 local communities in Latin America. Peru (26), Chile (25), Argentina (24) and Brazil (21) have the highest number of mining conflicts (OCMAL, 2011). The Brazilian Environmental Justice and Health database identifies 297 conflicts nationwide. The main affected groups are indigenous communities (34%) and peasant families (32%) (FIOCRUZ, 2011). Social movements developing these tools believe that as pressures to extract resources grow, socio-environmental conflicts are multiplying and spreading at regional and global scales. In this context, an increasing number of communities are reacting, searching for information and experiences. Most of the databases mentioned above aim to provide useful information on the impacts of polluting activities, and background information about the strategies of mining companies, governments, communities and activist networks (OCMAL, 2011). In Argentina, national coordination and experience sharing among local communities has led to the ban of open pit mining in 7 of the 23 national provinces. Moreover, after the emblematic referenda of Tambogrande (2002 in Peru) and Esquel (2003 in Argentina) that forced the cancelation of local mining projects, dozens of communities in countries such as Peru, Chile, Ecuador and Guatemala are mobilising and conducting popular referenda or consultations about mining, often taking the ILO 169 Convention as legitimacy tool (OCMAL, 2011).

Referring to the Conga gold and copper mining project, led by the US-based firm Newmont and the single largest foreign investment in Peru (US$ 4.8 billions), the Financial Times wrote in an article ("Mines in the Andes") on 7th December 2011 that "many new projects are taking place in ever more distant and environmentally fragile locations". "After 11 days of protests against a gold mining project in Cajamarca, Ollanta Humala, the newly elected president (of Peru), on Sunday (4th Dec. 2011) declared a state of emergency and sent in the army to restore order" (ibid). One week later, however, the Prime Minister of Peru resigned as the conflict was not yet solved, triggering a reshuffle of the whole cabinet. This case (motivated by concerns about water availability and pollution) reflects clearly the high-level political leverage that grassroots mobilizations against the expansion of the commodity frontiers might have. A related event, but in a much smaller scale, occurred on 5th March 2012, when a group of women, mostly from Acción Ecológica ,"occupied" peacefully the Chinese embassy in Quito to deliver a letter to the Ambassador complaining about a contract to be signed the same day between the Chinese (formerly Canadian) mining company ECSA

and the Ecuadorian government. The contract launched the development of Mirador, the first large scale open cast copper mine of Ecuador, located in the Cordillera del Condor south-east of the country, close to the border with Peru. After a couple of hours the women were arrested by the Ecuadorian police, and later released without charges. The banners read “Fuera empresas chinas de Ecuador” (Chinese companies, get out of Ecuador), perhaps the first time in the history of Latin America that such a slogan is raised, but probably not the last one.[2]

We consider the scale of social metabolism as the ultimate driving force of such ecological distribution conflicts (Martinez Alier et al. 2010). However, between the material and energy flows in the economy and the actual occurrence of socio-environmental conflicts there is a large variety of “mediating” variables involved, as summarized in Table 1. Social-environmental conflicts are typically complex in the way they emerge and are configured. As stated above, they usually encompass different layers and networks of social actors. Due to this complexity, generalizations about why do they arise and how they evolve are hard to achieve. Conflicts are determined by the way the territory is used and appropriated by actors, by population density, by the characteristics of the commodities in question and the technologies of exploration or exploitation, as well as by the formal and informal institutions in place, including the right to protest. An open-pit mine in a heavily populated area located in a democratic state, whose indigenous dwellers depend on irrigated agriculture as the main source of livelihood, has a higher probability to trigger an open conflict than an underground mine far away from populated areas, and in an autocratic political system. Local perceptions about risks, historical traditions (as in Cajamarca, where Pizarro met Atahualpa) as well as the prevailing notions of identity and fairness constitute another level of causality. When there is a clash between the perception of risk by technicians and other social groups, conflicts are more likely (Muradian et al., 2003). As well, in case of forced displacement and a skewed distribution of benefits, the probability of confrontations is higher, depending on the degree of authoritarianism of the state and fear in the population. We can expect these variables to vary greatly between world regions, and even among regions within a national territory. In the case of mining for example, due to a number of factors, the material expansion of exploitation is less likely to be related to a higher incidence of conflicts in places like northern Chile, Australia or Canada, compared to locations in Colombia, some parts of Indonesia, Peru, Ecuador or other more densely populated areas in the tropics. Conde and Kallis (2012) analyse how, in the case of the ongoing uranium mining rush in Namibia, the role of risk perception, population density, the expectations of benefits by local communities and the configuration of environmental networks can shape (the absence of) local resistance in the places surrounding current or future mines. Sometimes, conflicts have unexpected results, Veuthey and Gerber (2012) highlight the role of local women in the struggle for the preservation of mangroves in Ecuador, and how participation in this social movement has had the unexpected outcome of empowering women in local gender relations.

We think that the in-depth analysis of case studies provides valuable analytical inputs. However, the next step in the advancement of political ecology is the meta-analysis of cases, along different world regions and commodities, in order to identify regular patterns. Such exercise (facilitated by the previously mentioned databases) will enable the consolidation of a general theory of resource extraction conflicts, which is still under construction.

[2] http://www.france24.com/en/20120305-ecuador-sign-mining-contract-with-chinese-firm

Table 1: Ultimate and proximate drivers of socio-environmental conflicts

Driving forces of socio-environmental conflicts		
Physical factors	*Geographical, ecological, technological demographic and socio-cultural factors*	*Perceptions and institutional factors*
Scale of social metabolism	Characteristics of exploitation (type of commodity, location, technology, local environmental transformations; distribution of impacts, vulnerability of local ecosystems) Way of use and appropriation of the territory (population density, socio-cultural practices, distribution of benefits; prevalent land use)	Levels and forms of social organization Networks and alliances at different scales PR practices of enterprises Perceptions about identity, fairness and risk by local social groups

Though socio-environmental conflicts do not always emerge when expected and they are rarely successful in achieving their goals, mobilizations by indigenous groups in Peru against oil and gas exploitation in the Amazon, culminating in the clash in Bagua in June 2010 (Stetson, 2012) or in Bolivia in 2011 against the construction of a road in the TIPNIS national park have shown that social movements can actually re-draw the commodity frontiers (in both cases social mobilization stopped at least for some time the large-scale projects in question). “Indigeneity” and other forms of class or social struggle might emerge as decisive factors in reinforcing socio-environmental conflicts, particularly among rural communities whose livelihoods and means of subsistence are threatened by projects that would mainly provide economic benefits to other social groups. Though the current boom in the price of commodities might provide additional economic resources for the prevention or resolution of socio-environmental conflicts, we hypothesize that the concomitant expansion of the extraction frontier is setting the conditions for the emergence of new socio-environmental conflicts. We can therefore expect a rise in the incidence and the political leverage of socio-environmental conflicts in resource-rich countries, particularly those with high population density, relatively democratic regimes, sensitive ecosystems and where indigenous and other vulnerable social groups (whose livelihoods highly depend on local natural resources) inhabit the “commodity frontiers”.

In summary, on the one hand, the expansion of global social metabolism is inducing the growth of socio-environmental conflicts worldwide, but particularly in regions with ecologically vulnerable ecosystems, an intensive human occupation of the territory and high levels of social organization. On the other hand, social movements of resistance are able sometimes to stop, or at least delay, the expansion of the extraction frontier, and to re-draw its limits. The study of social metabolism (as carried out in ecological economics and industrial ecology) thus could converge with studies from the fields of political ecology and environmental sociology unfolding the relationship between the throughput of the economy and the dynamics of socio-environmental conflicts in the places of extraction.

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