

# THEORY OF REGULATION AND POLITICAL ECOLOGY: AN INEVITABLE SEPARATION?\*

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## INTRODUCTION

In his contribution on ecology to the compendium “La théorie de la régulation: l’état des savoirs”, Alain Lipietz observes that, although several prominent regulationists have joined the ecological movement, few regulationist analyses deal with ecological issues (LIPIETZ, 1995a). In a way, this observation is pertinent to Alain Lipietz himself. Thus, the question whether or not the regulationist approach and political ecology are compatible arises.

In this article, departing from a critique of Lipietz’s dichotomy between theory of regulation and political ecology, we aim at presenting a proposal on how to integrate political ecology and the theory of regulation. We regard this necessary for both theoretical and political reasons, since for one thing the theory of regulation lacks a systematic treatment of social relations with regard to the interaction between society and nature, while concepts of political ecology, notably that of Alain Lipietz as outlined in Lipietz (1998b), lack a critical analysis of political economy. In the last part of the paper, we will illustrate how social relations to nature interact in the current process of colonization of biodiversity, which we think might eventually form a central part of a new regime of accumulation.

## LIPIETZ AS A POLITICAL ECOLOGIST: THE TURN TO A NORMATIVE APPROACH

Alain Lipietz’s turn from the marxist left to political ecology is motivated by his perception that the latter is today’s most effective form of a “double opposition to fordism of the past and liberal productivism of our times” (LIPIETZ, 1995b: 43). In this political turn, he does not, however, sever all ties to Marxism. In several contributions (LIPIETZ, 1997; LIPIETZ, 1998a), he elaborates on parallels in the approaches of Marxist political economy, of which, to a considerable extent, the regulationist approach is an offspring, and political ecology. He underlines that both share a dialectical, historicist and basically materialistic approach.

In his perhaps most elaborate reasoning regarding this issue, Lipietz (1997: 674-683) sketches the interaction of economic activity and the environment and the regulation of this interaction in a very long-term perspective from the neolithic age to the “great crisis” of late feudalism and to the present “great crisis” of capitalism. He stresses that periodically, the way the environment has been dealt with has become untenable. “Great” ecological crises have arisen. In these crises, it has become imperative to develop new ways of regulating human interaction with the environment. This re-regulation has been subject to social conflict. The outcome of these conflicts is not predetermined (1997: 675). Somewhat surprisingly for a regulationist, Lipietz does not systematically deal with the specificity of social relations to nature in capitalism. He neglects the systematic drive to accumulate that divides capitalism from other modes of production. By discussing social conflicts dealing with ecological issues, he focuses rather on the consumption than on the production sphere (LIPIETZ, 1997: 683; LIPIETZ, 1998a: 69).

At the end of his analytical discussion, Lipietz (1997: 684) gives his reasoning a somewhat surprising turn. In a logically cogent conclusion, he states “that we do not know any more what future generation will deem ‘better’” (ibid.). However, he does not want to leave things at that. He wants to develop building blocks for the future dealing with ecology. These building blocks are “values” Lipietz regards as “secure”: autonomy, solidarity and responsibility (ibid.). Thus, “political ecology” is understood as “a type of humanism because it recognizes a moral dimension, to be approved or condemned, in the actions of a particular species” (LIPIETZ, 1992: 51).

Thus, it seems that Lipietz has not one, but two conceptions of political ecology. The first one is analytically orientated. It shares the historicist, dialectical and a basically materialistic approach with the theory of regulation. Lipietz regulationist analyses (e.g. LIPIETZ, 1985 a; LIPIETZ, 1988) and the article referred to above conceptualises great crises as critical junctures and politically comparatively “open” historical situations where there is an intensified struggle for new dispensations. Thus far, it would seem possible to couple the regulationist approach and political ecology. Lipietz himself, however, leaves open fundamental questions, such as: What is the status of ecology in a regulationist approach? What significance does nature have for the accumulation process? Is the regulation of man’s relationship with nature a “structural form” of capitalist regulation or can it be subsumed e.g. under the relations of competition? What type of social conflicts give rise to ecological regulation?

The way for this flight into the world of ‘values’ is to some extent paved by the insufficient theoretical treatment of the specificities of social interaction with nature in capitalism. This rather blind spot permits Lipietz to resort to moral exhortations.

Lipietz’s second conception of “political ecology” is not analytical, but normative and prescriptive. It is centred around appeals to ethical values, in this case solidarity, autonomy, ecological responsibility and democracy. It turns the materialist approach on its head, and indeed could be regarded as “idealist”. It therefore represents a break with the tradition of political economy and, hence, with the regulationist approach itself. This second version of “political ecology” does not present us with the

analytical tools to deal with this interaction of an accumulation strategy and the environment, nor with the ideological representations of this interaction and its regulation, e.g. neo-classical resource and environmental economics.

### **THE POSSIBLE 'MARRIAGE': ELEMENTS OF AN ECOLOGICAL DIMENSION OF THE REGULATIONIST APPROACH**

#### **Regime of accumulation**

To us, it seems to be both possible and necessary to integrate man's relationship with nature into the theory of regulation. It seems most appropriate to start with the valorisation process as this was done in the seminal contribution of Michel Aglietta (1987). The valorisation process is defined as M-C-M' (M= Money, C=Commodity), but, in a more encompassing way, should be conceptualised so as to integrate nature. As Deléage (1994: 38) observes, nature serves both as "source and sink" in the valorisation process and the interaction with nature, and thus constitutes the "first and last phase" of capitalist, and other modes of production. Production in capitalism, however, serves only one purpose, i.e. to make more money from an initial endowment of money capital. The imperative of accumulation, therefore, drives the valorisation process, and only as a consequence thereof does intercourse with nature happen. In the process of production, not only is labour exploited, but also nature is needed; Nature as (i) providing material and energetic inputs, and as (ii) serving as a sink for the externalities of production. As Marx already pointed out, nature interferes in various other ways with production, e.g. in determining production time with a given technology (e.g. the period between sowing and harvesting an agricultural product), or in influencing the rate of reinvestment (as a consequence of material erosion of productive capital) (cf. MARX, 1986). Thus, we can rewrite M-C-M' to: M-C/N...C'/N-M'. By contrast to systems models of the economy-nature nexus, where the central role of capital, and hence accumulation, is excluded, models that are commonly used by environmental as well as ecological economists (cf.e.g. PEARCE & TURNER, 1990:40), the above outlined conceptualization is better-suited to describe the dynamics of society's relation to nature in capitalism. A relation that is governed by the imperative of accumulation through the production of exchange value.

Nature's role in the accumulation process can take on various forms. According to O'Connor (1998), nature can be conceptualized as being one of three conditions of production, the first being that which Marx called the external condition of production, which capitalist accumulation is based upon. The other two are the personal condition of production, i.e. labour power, and the communal, general condition of production (physical and social infrastructure, human-made space). Because these conditions are not produced capitalistically, but are treated as fictitious commodities, which are exchanged through markets, their conditions of supply have to be regulated by the state, and hence, are subject to political dispute as to the specific forms of their utilization between capital and other social forces. Ever in search for accumulation

and profit maximization, capitalists will try to reduce access and utilization costs of conditions of production, hence externalizing as much as possible of these costs upon society and thus unintentionally upon capital as a whole, which at the limit will result in an overall reduction of profits for capital.<sup>3</sup> As a consequence, this “second contradiction of capitalism”, as James O’Connor termed it, will result in an under-production crisis, where less surplus value is produced than possible because of the high costs of exploiting the (external) conditions of production.

O’Connor (1998) developed this concept further so as to integrate expansionary as well as contracting phases of the accumulation process. Since during the former, expanding markets have to be served, the pressure on nature will increase accordingly, i.e. resources will be depleted faster, resource efficiency hence being no issue of importance for capital. Under these conditions, capital in principle could afford to improve on its environmental standards, the extent to which this materializes, will, however, depend upon the success of political pressure by civil society. Quite to the contrary, during periods of crisis, pressure on industries’ cost structure increases. Capital will respond to these pressures by trying to reduce costs of access and utilization of production conditions. Since it has to meet a contracting market demand, its aim will be cost-cutting in order to restore profitability, both by political pressure towards a revaluation of production conditions (flexibilization of labour markets, downgrading of environmental standards etc.), and by economic measures to increase efficiency, such as the introduction of new technologies, reduction in the size of the labour force etc.

It seems to us that O’Connor’s model serves well to explain why capitalist economies are crisis-ridden as a consequence of their contradictory relationship with production conditions. Many empirically-observable features of the restructuring of capitalism in the present crisis are thus adequately accounted for by the second contradiction. Little is said, however, to explain phenomena such as the widespread privatisation of the communal conditions of production as well as the (intended) privatization and monetization of nature as a consequence of the dominant neo-liberal doctrine. As far as nature is concerned we think this is due to a lack of theorizing nature as a “productive force” for capitalist accumulation, especially during periods of economic crisis, which by the same token, is a process of search for a new regime of accumulation. Whatever the driving forces of the accumulation process are (money/interest, profit, competition), it seems clear to us, that in the long run any successful capitalist accumulation can only be accomplished through the exploitation of the labour force, i.e. through the creation of surplus value.<sup>4</sup> Since labouring intrinsically involves acts of physical transformation of nature, that is, the creation of use values, the question for capital is, what kind of nature is to be transformed in order to produce what kind of commodities for the satisfaction of which existing, or yet to be introduced, needs? While this is a question to which there is no general answer, the important issue here is that the satisfaction of every novel or already established need necessarily depends upon a material base, a base, of course, which in the interest of capital is to be subsumed under capitalist relations of production in order to be exploited.<sup>5</sup> Drawing

upon a tradition going back to Rosa Luxemburg (1912), with recent important contributions by Altvater (1992) and Altvater & Mahnkopf (1996), we argue that the mechanism by which this base is secured, is that of expansion into realms previously outside the capitalist mode of production, be it in social (e.g. capitalization of the reproduction of labour force), spatial (colonization of new territories) or natural terms (exploitation of novel forms of nature). The possibilities for expansion will depend upon a variety of factors, such as the organization of production, the state of science/technology, ideology, culture etc. Nevertheless, in the last instance, the whole process is determined politically, i.e. it is decided in the political arena, if, and what specific form of, expansion is going to be effected or not.

The “nature” of the current crisis of capitalism is characterized by a secular increase of the importance of finance capital (cf. GUTTMANN, 1999). Huge amounts of money are shifted from one “hot” region of the globe to another in constant search for realization. Though these profit-rates could recover from the low levels of the 1970s, the well known series of financial crises during the 1990s (Mexico 1994, East Asia 1997/98, Russia 1998, Brazil 1998/99) provides clear evidence that the whole process of financial accumulation is highly unstable and volatile. Fictitious capital cannot be accumulated forever. For the installation of a stable new regime of accumulation, it will be a necessary prerequisite that the masses of finance capital be realized through a process of surplus-value production. Hence the expansionary pressure to capitalize the conditions of production, as witnessed by neo-liberal reforms throughout the globe, such as the privatization of physical and social infrastructure, the flexibilization of labour markets, and the intrusion of science/technology into natural domains (e.g. the human genome, the biodiversity of tropical regions), with the sole aim of exploiting them for exchange-value production.

### **Mode of regulation**

The interaction with nature, i.e. the material world of objects, has both a quantitative and a qualitative side. The quantitative side is defined by the second thermo-dynamic law (GEORGESCU-ROEGEN, 1971). Man’s relation to nature for productive purposes materializes in the extraction of energy and matter, as well as in the dissemination of the residuals of the economic process into the environment. Many of these materials, notably such central ones as hydrocarbons and minerals, have finite stocks, while the capacity of ecosystems to absorb the impacts of human activity is also limited. Thus, stocks and the change of stocks are essential features of the physical environment, ecological regulation has to deal with. Ecological economics has made important contributions to our understanding of these physical aspects of man’s relation to nature (see e.g. MARTINEZ-ALIER, 1987). We think, however, that a static and/or biologicistic perception of nature - nature as something completely exogenous to the social realm - which is common to neo-classical environmental/resource economics and ecological economics alike, would fall short of essential aspects of the relation between nature and society. First of all, nature is a social construction with a double

meaning: on the one hand, the term 'nature' represents a variety of concepts that aim at comprehending the material world of objects surrounding, but also including humans (cf. HARVEY, 1996:117 et seq.); on the other hand, nature is constructed in material terms by social, productive as well as reproductive praxis. Concepts of nature are of course subject to historic change, since for one thing, the material world is permanently transformed through human labour - nowadays it is to a large extent a built environment - and for another thing, the perception of nature by humans themselves changes (cf. VOGEL, 1996). Secondly, the relation between nature, i.e. the material world, and society possesses contradictory and conflictual characteristics, and is not at all a harmonious "nature" *per se*: "The finiteness of nature and of the Earth has the power to challenge blind (ideological) belief in the infinite power of abstraction, of human thinking and technology, and of political power and the space which that power generates and decrees.", as Henri Lefebvre writes (1991:330). This dialectical process governed by the interaction of material objects and human subjects eventually does not only lead to the destruction, but also to the creation of nature: "resources are not; they become" as institutional economists like Clarence Ayres and Erich Zimmermann have pointed out some 50 years ago (cited in DE GREGORI, 1987). The notion "resource", hence, does not only imply a physical, but also a social component, i.e. the technological capability to manipulate matter/energy in a determined way (ibid.). Moreover, it depends upon theoretical concepts, cultural perspectives and specific social constellations (HEINS & FLITNER, 1998).

However, the specific form of the utilization of energy/matter is subject to regulation, i.e. governed by human action. And this is where the theory of regulation as a systematic attempt to theorize social relations comes into play. Accumulation strategies need a material base. However, certain accumulation strategies require specific forms of access to specific forms of nature. Thus, the protagonists of such strategies strive for specific forms of ecological regulation. At a certain point, such regulations might lose their viability which might result in small crises that can be dealt with by minor adjustments or "great crises", which in turn open a major conflict about ecological re-regulation that contributes to paving the way to a new regime of accumulation. In capitalist economies, the ultimate goal of any utilization of natural resources is its commodification and valorisation in the market. Since the generalisation of the commodity-form is the central characteristic of capitalism, and the commodity is the reification of specific social relations (LUKÁCS, 1923; 1997), it follows that social relations to nature are subject to the same process of reification. Reified nature, i.e. the commodified environment itself, is a representation of certain social relations, an example of which would be power relations inscribed in landscape architecture (cf. ROTENBERG, 1995), or in the spatial segregation of housing of different social classes in cities (HARVEY, 1973). Hence nature (including space) is as much created, transformed or destructed by social processes, as it is by universal natural laws.

Because of its complexity, it does not seem appropriate to us to subsume ecological regulation under any one of the five structural forms defined by the theory of regulation. Various authors, e.g. Demirovic (1997) or Görg (1999) call this structural

form of capitalist regulation “gesellschaftliches Naturverhältnis” (social relation to nature). As the material world constitutes a constraining factor of capitalist production like money, it could also be termed “ecological constraint” in analogy to Aglietta’s “monetary constraint” (AGLIETTA, 1987; cf. ALTVATER, 1987: 125 et seq.). This sixth structural form regulates access to, and utilization of, the material world both for productive and reproductive activities. Hence, it also regulates the spatial and temporal distribution of the ecological costs and benefits of these (re-) productive activities.

Like the monetary constraint, the ecological constraint is subject to socio-political conflict. Constraint for some is possibility for others (on this double nature of constraint see also GIDDENS, 1984). Various lines of conflict are possible. Ecological constraint may be an object of class struggle, e.g. the commodification of land and its form might be subject to struggle between capitalist and subsistence-oriented farmers. Aspects of human interaction with nature might be the object of conflicts within one class, e.g. the regulation of certain property rights might be contested between different factions of capital. On certain issues, multi-class alliances might be formed, e.g. on the rain-forest, though usually the agenda of such alliances is not homogeneous and one social group is predominant (cf. ENZENBERGER, 1997: 288 et seq). These political struggles are fought in civil society at different territorial levels (local, national, supranational). The actors aim at getting the sanction of the state (or – mediated through states – of an international organisation) for their solution so that it acquires mandatory force. Therefore, the state is the central structural form (LIPIETZ, 1985b: 11; COX, 1987: 105; BECKER, 1998: 120 et seq). It goes without saying that the ecological constraint is interrelated in various ways with all the other structural forms. The specific articulation of these, e.g. between ecological constraint and wage relations, will vary according to the predominant regime of accumulation: soil erosion in peripheral fordism led to the abandonment of subsistence agriculture and through migration to the establishment of a huge “industrial reserve army” or informal sector in the peripheral metropolitan areas; Contrary to that, soil erosion in fordism, though characteristically caused by the production process itself and not by external influences, presents a technical problem that impinges upon profitability, and hence eventually upon the relations of competition in agriculture.

A systematic analysis of the interaction between the ecological constraint and the other structural forms for the various types of accumulation-regimes has yet to be developed. It would certainly deepen our understanding of man’s relation to nature in specific socio-historic formations.

#### **BIOTECHNOLOGY AS THE NEW FRONTIER OF CAPITALIST ACCUMULATION: A SHORT ILLUSTRATION**

As various authors within the regulationist approach have observed, the fordist regime of accumulation has been in a state of crisis for roughly the last 25 years. This situation, where “the old is dying but the new is not yet visible”, as Antonio Gramsci (1971) lucidly put it, is characterized by a high degree of openness and an

intensified search for solutions to the crisis by the involved actors. While amongst regulationists the current crisis is predominantly perceived as being politico-economic in nature, it is beyond doubt also an ecological crisis. Ecological, however, not only in the sense that economic patterns of the present exploitation of the physical environment have become a severe threat to the integrity of ecosystems, but also that the capacity of present forms of valorisation of nature to contribute to the dynamics of accumulation is exhausted. Thus, the establishment of a new regime of accumulation will necessarily depend upon the integration of new forms of exploitation of natural resources and services (e.g. carbon sinks) into the valorisation process, natural resources and services that were in many cases previously outside the capitalist economy.

In the present “great crisis”, capital is constantly trying to open up new areas for capital accumulation. One of these new areas seems to be the biotechnology and genetic engineering industry.<sup>6</sup> Secular advances in scientific fields such as genetics, molecular biology or plant physiology throughout the 20th century, resulted in the development of diverse manipulative techniques (especially genetic-engineering), thus raising considerable expectations as to their economic potential for agriculture, pharmaceuticals and other sectors of the economy (cf. HEINS & FLITNER, 1998). Regardless of whether or not these expectations will actually be met in the future, capital, mainly in the form of transnational corporations, cannot afford to let this chance pass by unexploited. Besides, the spread of agroindustrial techniques throughout the globe led to a reduction and uniformization of plant varieties used for agricultural production, which ironically made capitalist agriculture more vulnerable to external shocks. This, too, increased the need for accessing an extended reservoir of biological resources. Accordingly, in many regions of the Third World, the emergence of a process that has been termed “Bio-prospecting” has to be noted. Following a scheme of colonisation and valorisation of nature that was advanced by Altvater/Mahnkopf (1996), bio-prospecting - environmentalists denounce it as bio-piracy - constitutes a primordial step in the colonisation process of biodiversity, directed at detecting the economic potential of species of plants or animals. It is only too obvious that in most cases, detecting only meant the unauthorized appropriation of plant/animal genetic resources, that were already in use in local societies. Another necessary step is the definition of, preferably individual, property-rights and its enforcement through the state or an international organization. The inclusion of a treaty on Trade-Related-Intellectual-Property-Rights (TRIPS) into the legal body of GATT/WTO, as well as the discussions about the introduction of patents on animal and human forms of life, are yet other clear signs of this colonisation process. The same applies to the Biodiversity Convention signed at the Rio Conference in 1992. While it recognises the importance of indigenous people and groups in the utilization and conservation of genetic resources, it fails to ensure them ownership and management rights, thus facilitating the process of the mercantilization of these resources through the market economy (GUHA & MARTINEZ-ALIER, 1997:115). The last step of this process, and at the same time its ultimate goal, is the commodification and monetisation of natural products in the market. Apparently, this has not yet been achieved.

Clearly the distributional consequences of the valorisation of bio-genetical material point to a well-known direction: to a transfer from those regions where bio-genetical resources are located, to the capitalist centres. The totalitarian aspiration of the centres "...to concentrate wealth, means of action, knowledge, information and 'culture'. In short, everything" remains a central tenet of capitalism (LEFEBVRE, 1991:332 et seq.). This colonisation and valorisation process, necessarily, constitutes a field of social conflict, be it for reasons of rivalry with other forms of utilization of a resource, or for ethical, religious or aesthetic reasons. Different economic interest groups, for example transnational agroindustrial and pharmaceutical sectors opposing indigenous/small-farmers movements, but also different legitimating rationalities, i.e. distinct conceptions and visions of the world and of nature, are confronting each other.

As Heins & Flitner (1998) point out, the international discourse on biodiversity oscillates between the legitimating poles of rescuing genetic resources and of preventing its rape. Accordingly, the solutions proposed in this conflict range from the absolute subordination of the forms of exploitation of these resources to a laissez-faire capitalism with an individualist property-rights regime in the name of humankind's interest for a prosperous future, to fundamental opposition to every form of the subsuming of these resources under a capitalist mode of production, exactly by arguing that subsuming of biodiversity under capitalist modes of production will be against the interests of humankind. The failure to sign a Biosecurity Protocol at the negotiations in Cartagena/Colombia in February 1999 serves as a vivid illustration of this highly disputed battlefield between conflictual interests, where none of the both sides is currently strong enough to push through its solution. While the group of Miami, integrating the largest exporters of genetically modified products under leadership of the USA, insisted upon an unrestricted international commerce in such products, the great majority of developing countries and the European Union demanded an international regulation of this kind of commerce in order to prevent damage to human health and the environment. It has to be remarked that a small, though powerful, group of countries including the USA was able to halt an agreement that was supported by more than 130 nations (SICA-AL No.61, 5.3.1999). Had it not been the case that the EU backed the latter group of countries, it would have been very likely that the USA would have succeeded with its liberalization proposal.

However, it is only with the development of biotechnology, that bio-genetic material was perceived as resources or "natural capital", and hence became a relevant object of economic and political concern. Thus, it is biodiversity's potential exchange-value as opposed to its use-value that is at stake in this conflict. And the realization of exchange-value implies an individual regime of property-rights, and, hence, the establishment of a regime of control and domination, which foreseeably will severely restrict non-market usage of these resources. Resources that are vital to non-capitalist modes of production.<sup>7</sup>

Clearly, other institutional forms will impact upon the process and its outcome. At the level of the nation-state, the interest groups opposed to a far-reaching

commodification of bio-genetical material are usually rather weak or even, especially in the South, totally marginalised. Both the states in the South, where most of the relevant genetic material is located, and the ecological, peasant and indigeneous movements, have only very limited influence on decision-making in the hard-core international organisations like GATT/WTO, IMF or OECD. Thus, the national and international balance of forces seems clearly loaded in favour of transnational capital. And yet, the recent conflict on the Multilateral Agreement on Investment (MAI) gave an indication that decentrally organized resistance may eventually lead to partial successes, though we are quite sceptical about its long term sustainability.

While at present it cannot be concluded that one of the conflicting parties has been totally successful in pushing through its solution to the conflict, the direction of change is only too visible. Biodiversity, notably as materialized in the tropical rainforests, will be subject to some form of subordination to capitalist modes of production and accumulation. The form of this subordination is, however, not yet totally decided upon. Thus, there remains some room for manoeuvre of an international alliance of ecological movements and peasant/indigenous organisations to push for some limits to the commodification of bio-genetical material and for the protection of the interests of those social groups that have continued to use these resources in a basically non-capitalist way up to now.

### CONCLUSION

It can be concluded that a separation between the regulationist approach and political ecology is neither inevitable nor desirable. Though in this short article we were only able to sketch some, yet important, issues regarding social relations to nature that merit theoretical consideration by regulationists, we think that the integration of the ecological dimension into the regulationist approach fills a gap in its theoretical corpus. Nature, from this perspective, must not be seen as something completely exterior to the social realm, but as a social construction, which evolves in a dialectical interplay between human subjects and material objects. Hence, concepts and material forms of nature are representations of social relations. As such, they are both the results and causes of social struggles as to the conditions of utilization of the material world. In a capitalist society, social relations to nature are to a large extent reified, since the ultimate goal of every productive use of material objects is its commodification. Hence, expansionary capitalist dynamics depends upon the permanent appropriation of the material world, thereby creating nature not only through new resources but by conditioning total human environments to the necessities of the valorisation process. Creation, of course, entails destruction as well, and it is the destructive consequences of capitalism, ecological concerns rightly address.

A proper understanding of the materialist conditions of capitalist dynamics, however, is an indispensable prerequisite for political environmental action. For it radically questions a “contemplative attitude” (Lukács) towards society, and moreover, of nature as being external entities governed by eternal natural laws, humans only

have the possibility of submissively adapting to. Thus, by following the idealistic Alain Lipietz in leaving analysis of nature exclusively to the natural sciences, while simultaneously taking refuge in some abstract Kantian "Sollensethik", we will neither be able to posit political ecology on firm theoretical ground, nor will it be possible to transform social relations to nature in a progressive way. We are convinced that only a materialist and dialectical analysis of social relations to nature will enhance our understanding so as to broaden the room for manoeuvre of ecological movements, an aspect that is of particular relevance to political activism.

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## NOTES

<sup>1</sup>This article was first accepted for publishing in *Economies et Sociétés*, cahiers de L'ISMÉA, série "Théories de la Régulation", R, n° 11, 2000.

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<sup>3</sup>Another example is the increasing costs of extracting raw materials, as more accessible and concentrated deposit sites are exhausted, which will require the input of more energy in extractive activities, or the deployment of new technology in extraction. Both of the latter will inevitably infer higher costs to capital (Deléage 1994)

<sup>4</sup>Though it goes without saying that accumulation can be exclusively accomplished through the financial sector, it is also clear that this presents only a temporary solution to the problem, since any financial bubble will sooner or later burst.

<sup>5</sup>We think, this argument is equally valid for so-called immaterial needs. In order to participate in virtual reality, for example, a physical infrastructure (telecommunication networks, personal computers etc.) is necessary, thus, in our viewpoint, qualifying the argument of an imminent dematerialization of the economy due to its tertiarization.

<sup>6</sup>In the following we will concentrate on the discussion of plant and animal genetic resources, thus leaving the different, though related issue of human genetic resources aside.

<sup>7</sup>To put it clear: We are not arguing in favour of restricting use of bio-genetic resources to those who have traditionally done so. Rather we question the form by which these resources are made available to an international public, for it strongly discriminates against those who originally developed the knowledge of how to use certain bio-genetical resources, and who depend upon them for their reproduction.

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WERNER RAZA & JOACHIM BECKER

**Teoria da regulação e ecologia política: uma separação inevitável?**

Partindo de uma crítica do conceito de ecologia política de Alain Lipietz por sua incapacidade de integrar ecologia política e a teoria da regulação, nós apresentamos um caminho viável de integração das duas abordagens através da formulação de uma sexta forma estrutural: a relação social frente a natureza ou restrição ecológica. Ao final, nós ilustramos a propriedade dessa categoria aplicando-a a uma análise dos recentes desenvolvimentos na indústria de biotecnologia.

Palavras-chave: ecologia política, teoria da regulação, A. Lipietz.

**Theory of Regulation and Political Ecology: an Inevitable Separation?**

*Departing from a critique of Alain Lipietz's concept of Political Ecology for its failure to integrate Political Ecology and the Theory of Regulation, we present a possible way of integrating the two approaches via the formulation of a sixth structural form: social relations towards nature or ecological constraint. Finally, we illustrate the usefulness of this category by applying it to an analysis of recent developments in the biotechnology industry.*

*Keywords: political ecology, theory of regulation, A. Lipietz.*

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GUILLERMO FOLADORI

**Sustentabilidad ambiental y contradicciones sociales**

Neste artigo analisamos as definições e medições de sustentabilidade. Mostramos que enquanto as definições incluem um elemento inter-geração e um outro de equidade intra-geração, a maioria das medições somente recuperam o primeiro elemento. Explicamos as razões metodológicas desta restrição e mostramos, assim mesmo, a possibilidade de utilizar outros critérios —como o de produtividade social e excedente potencial— que dam conta das problemáticas ambientais derivadas das relações sociais. Palavras-chave: sustentabilidade, meio ambiente, desenvolvimento sustentável.

**Environmental sustainability and social contradictions**

*In this article we analyze the definitions and measures of sustainability. We show that while definitions include an inter-generation element and another of intra-generation equity, most of the measures only consider the former. We explain the methodological reasons for that, as well as demonstrating the possibility of including other criteria —such as social productivity and potential surplus— which explain environmental problems derived from social relations.*

*Keywords: sustainability, environment, sustainable development*