Progress in Physical Geography 22,1 (1998) pp. 79–94

Power, knowledge and political ecology in the third world: a review

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Abstract: Political ecology examines the political dynamics surrounding material and discursive struggles over the environment in the third world. The role of unequal power relations in constituting a politicized environment is a central theme. Particular attention is given to the ways in which conflict over access to environmental resources is linked to systems of political and economic control first elaborated during the colonial era. Studies emphasize the increased marginality and vulnerability of the poor as an outcome of such conflict. The impact of perceptions and discourses on the specification of environmental problems and interventions is also explored leading on to debates about the relative merits of indigenous and western scientific knowledge. Future research needs also to address issues linked to changing air and water quality, urban processes, organizational attributes and the human body.

Key words: Political ecology, third world, power relations, knowledge construction, conflict over access.

> The Cacao lands, a region embracing all of the southern part of the state of Bahia in Brazil, were fertilized with blood. They were conquered foot by foot in ferocious struggles of indescribable violence … At the very time that the seedlings were being planted, crosses were being set up to mark the spots where the brave had fallen, victims of ambushes or of encounters between hired gunmen (Amado, 1989: vii).

I Introduction

The environment is the focus of unparalleled scholarly, policy-making and public concern at the end of the twentieth century. Researchers investigate the social and physical dimensions of environmental change. Public anxiety grows as perceptions of environmental degradation spread, and is channelled notably into environmental activism and 'not-in-my-backyard' (NIMBY) campaigns. Political leaders organize environmental summits dedicated to the consideration of diverse environmental problems.

Much of this concern has manifested itself since the late 1980s in the promotion of the concept of 'sustainable development'. This concept, which would integrate environmental

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conservation with economic development, became a rallying cry for a heterogeneous group of politicians, state officials, business leaders and nongovernmental organizations keen to incorporate environmental considerations into the development process without unduly disrupting that process (Middleton *et al*., 1993; Redclift, 1987; 1996; Taylor, 1996). It was the guiding vision behind the United Nations conference on environment and development held in Rio de Janeiro in June 1992 which has set the tone for official environmental initiatives around the world ever since.

Yet these initiatives have failed to alter the policies and practices that are linked to various environmental problems. Indeed, a 'business-as-usual' approach has been adopted by political and business leaders seemingly content to avoid making the tough choices that a transition to 'sustainable development' would appear to necessitate. As a result, while the mainstream environmental literature has hit an impasse, calls for a detailed understanding of the political and economic obstacles to meaningful change have encouraged rapid growth in 'political ecology' research (Bryant, 1997a). It is the objective of this article to review briefly the historical development, as well as some of the key themes in the political ecology literature as it pertains to the third world in order to demonstrate how this research may clarify the political basis of many contemporary environmental problems.

II Bringing politics and ecology together

At the heart of political ecology research is the notion that politics should be 'put first' in the attempt to understand how human–environment interaction may be linked to the spread of environmental degradation. The development of third-world political ecology as a multifaceted research field since the 1970s occurred in the first place because of the perceived apolitical nature of existing environmental research (Peet and Watts, 1996a; Bryant and Bailey, 1997). The field has continued to prosper in the measure that alternative explanations have failed to account for the 'political sources, conditions and ramifications of environmental change' (Bryant, 1992: 13).

An article by Wolf (1972) is considered to be one of the first works in what would one day become third-world political ecology, but no 'classic' piece marked the advent of the field. Rather, the latter owes its origins to developments in the related fields of radical development geography and cultural ecology. The emergence of radical development geography, a subdiscipline of geography, has been particularly influential in the development of third-world political ecology. Although radical development geography was part of a larger revision of geography beginning in the late 1960s, it gained momentum in the 1970s partly as a result of its long-running campaign against neo-Malthusian notions of how best to deal with the world's growing population and ecological 'crisis'. For example, work by Buchanan (1973), Darden (1975), Lowe and Worboys (1978) and Wisner *et al*. (1982) published in the journal *Antipode* attacked diverse aspects of the neo-Malthusian viewpoint, and was part of a broader assault on mainstream environmental research for its neglect of questions derived from political economy (Corbridge, 1986; Adams, 1990).

A sense of what such questions might mean for research was embodied notably in work by radical geographers on 'natural' hazards and disasters. O'Keefe (1975) and Wisner (1976; 1978) initiated a process of inquiry into the interaction of political-economic structures with ecological processes that culminated in an alternative research

agenda published on the subject of disasters and hazards in the early 1980s (Susman *et al*., 1983; Watts, 1983b). That agenda was focused on disasters and hazards, but was simultaneously a wider comment about the need for work on the political economy of environmental change in the third world. As such, it was an influential strand in the development of third-world political ecology, a point acknowledged in key political-ecology texts (e.g., Blaikie, 1985; Blaikie and Brookfield, 1987).

A separate strand in the evolution of third-world political ecology relates to work on environmental topics in anthropology during the 1960s and 1970s. Cultural ecology (or ecological anthropology) sought to explain the links between cultural form and environmental management practices in terms of adaptive behaviour with a closed ecosystem (Bennett, 1976; Hardesty, 1977; Orlove, 1980; Ellen, 1982). However, the emphasis on energy flow modelling and systems analysis resulted in a general unwillingness or inability to see that the local-level cultural and ecological communities being studied formed part of (and were influenced by) a much wider set of political and economic structures (Simmonds, 1993; Peet and Watts, 1996a). This work used 'ecology' to emphasize the homeostatic and apolitical nature of human–environmental interaction (Adams, 1990).

However, cultural ecology had become the subject of growing criticism by the early 1980s. Hjort (1982) and Grossman (1984), for example, emphasized the need to couch anthropological insights about human–environmental interaction in the context of an appreciation of the wider political and economic structures that influence activity in any given locality – what Vayda (1983) termed 'progressive contextualization'. The integration of anthropological-style local research with political-economic structural analysis thereafter became a key concern of political ecologists (e.g., Hecht, 1985; Little and Horowitz, 1987; Bassett, 1988).

Political ecologists seeking to integrate place and nonplace-based analysis turned mainly to neo-Marxism in the late 1970s and early 1980s. The latter was heterogeneous in nature and encompassed dependency theory (e.g., Frank, Cardoso, Faletta), world-systems theory (e.g., Wallerstein) and modes of production theory (e.g., Rey, Meillassoux). This work has been reviewed extensively elsewhere (Taylor, 1979; Peet, 1991; Hettne, 1995), but what is important to note here is that neo-Marxism was at its most influential in the social sciences at a time when many political ecologists sought a radical theory to inform their contextual analyses. To be sure, resource depletion had long been a theme in Marxist scholarship, even in a third-world context (Frank, 1967; Caldwell, 1977). However, Redclift (1984: 13) rightly notes that 'Marxist writing about the development process has accorded a secondary role to the natural environment' – a point explored subsequently in debates about ecology and Marxism (O'Connor, 1988; Benton, 1989; Grundemann, 1991; Castree, 1995). Yet, for many political ecologists writing on the third world in the first half of the 1980s, neo-Marxism offered a means to link local social oppression and environmental degradation to wider political and economic concerns relating to production questions (Blaikie, 1985; Bunker, 1985).

During the first phase of third-world political ecology, which can be said to have run from the late 1970s until the mid-1980s, scholars resorted to neo-Marxism as a way of avoiding the perceived apoliticism of work by many cultural ecologists and neo-Malthusian writers. Watts (1983a), Blaikie (1985) and Bunker (1985), for example, situated their studies on northern Nigeria, soil erosion and the Amazon, respectively, in a structural framework informed by neo-Marxist ideas. Although these studies provided rich empirical insights, the emphasis on structure tended at times to downplay the ability

of politically or economically weaker grassroots actors such as small-scale farmers or shifting cultivators to resist their marginal status. However, the neo-Marxist basis of third-world political ecology at this time was nowhere more evident than in work by Cliffe and Moorsom (1979), Hedlund (1979) and O'Brien (1985) published in the *Review of African Political Economy* which explained local environmental conflicts in terms of class relations and surplus extraction linked to global capitalist production. The role of local politics in mediating resource access and conflict was thereby often largely neglected, and discussion of different actors (i.e., states, businesses, farmers) verged at times on the simplistic (Moore, 1996). The state, for example, was typically seen as being little more than an agent of capital, thereby obscuring both the potential autonomy of this actor *vis-à-vis* capital, and the diversity of bureaucratic interests that the state often encompasses.

Concerns over the influence of deterministic neo-Marxism on the field's development led in the late 1980s to the start of a second phase in third-world political ecology that has drawn on a more eclectic range of theoretical sources. Blaikie and Brookfield (1987), Guha (1989) and Hecht and Cockburn (1989) initiated this process with work on land degradation, the Amazon and India, respectively, but were soon followed by a flood of studies by other scholars (e.g., Neumann, 1992; Peluso, 1992; Neumann and Schroeder, 1995; Peet and Watts, 1996b) all of which sought to demonstrate a more complex understanding of how power relations mediate human–environmental interaction than was hitherto the case. In doing so, political ecologists have linked their research to a diversity of theoretical literatures that defy easy classification. Thus, scholars have drawn on neo-Weberian theorizing in political sociology (Skocpol, 1985; Mann, 1986) to explore the implications for environmental conflict of the potentially autonomous state (Peluso, 1992; Bryant 1997b). The potential power of grassroots actors such as poor farmers and shifting cultivators in environmental conflicts has been emphasized with reference to the concepts of avoidance behaviour (Adas, 1981) and everyday resistance (Scott, 1985) as part of an attempt to link political ecology to developments in social movements theorizing (Guha, 1989; Peluso, 1992). Scholars influenced by household studies (Guyer and Peters, 1987; Berry, 1989) and ecofeminist writings (Agarwal, 1992; Jackson, 1993) have examined how power relations within the household influence the control of land, natural resources, labour and capital (Schroeder, 1993; Carney, 1996). Finally, and more recently, work has started to draw upon 'poststructuralism' and 'discourse theory' (Said, 1978; Bhabha, 1994; Escobar, 1995) to map the ways in which knowledge and power may inter-relate so as to mediate political-ecological outcomes (Fairhead and Leach, 1995; Fortmann, 1995; Jewitt, 1995a; Escobar, 1996; Peet and Watts, 1996b).

The historical development of third-world political ecology indicates a research field that aims generally to relate political-economic and ecological processes, albeit through a plurality of approaches (Bryant and Bailey, 1997). Yet an underlying assumption is that politics and environment are everywhere thoroughly interconnected. As Harvey (1993: 25) observes,

> all ecological projects (and arguments) are simultaneously political-economic projects (and arguments) and vice versa. Ecological arguments are never socially neutral any more than socio-political arguments are ecologically neutral. Looking more closely at the way ecology and politics interrelate then becomes imperative if we are to get a better handle on how to approach environmental/ecological questions.

Political ecologists are thus keen to understand the dynamics and properties of a 'politicized environment'. One way in which to represent that environment is through

what Blaikie (1995) terms 'a chain of explanation' surrounding specific environmental problems (see also Blaikie and Brookfield, 1987; Blaikie, 1989).

Using the example of land degradation (see Figure 1), Blaikie starts with physical changes in soil and vegetation (box A) and their associated economic symptoms (box B), links these to location-specific land-use practices (box C) as well as individual and collective decision-making processes (boxes D and E), before ending up with wider contextual forces associated with the state (box F) and the international economy (box G). At each point in the chain of explanation, the ambiguities and complexities associated with understanding and then linking social and environmental processes are emphasized. Thus, the connection between physical changes and their economic symptoms on

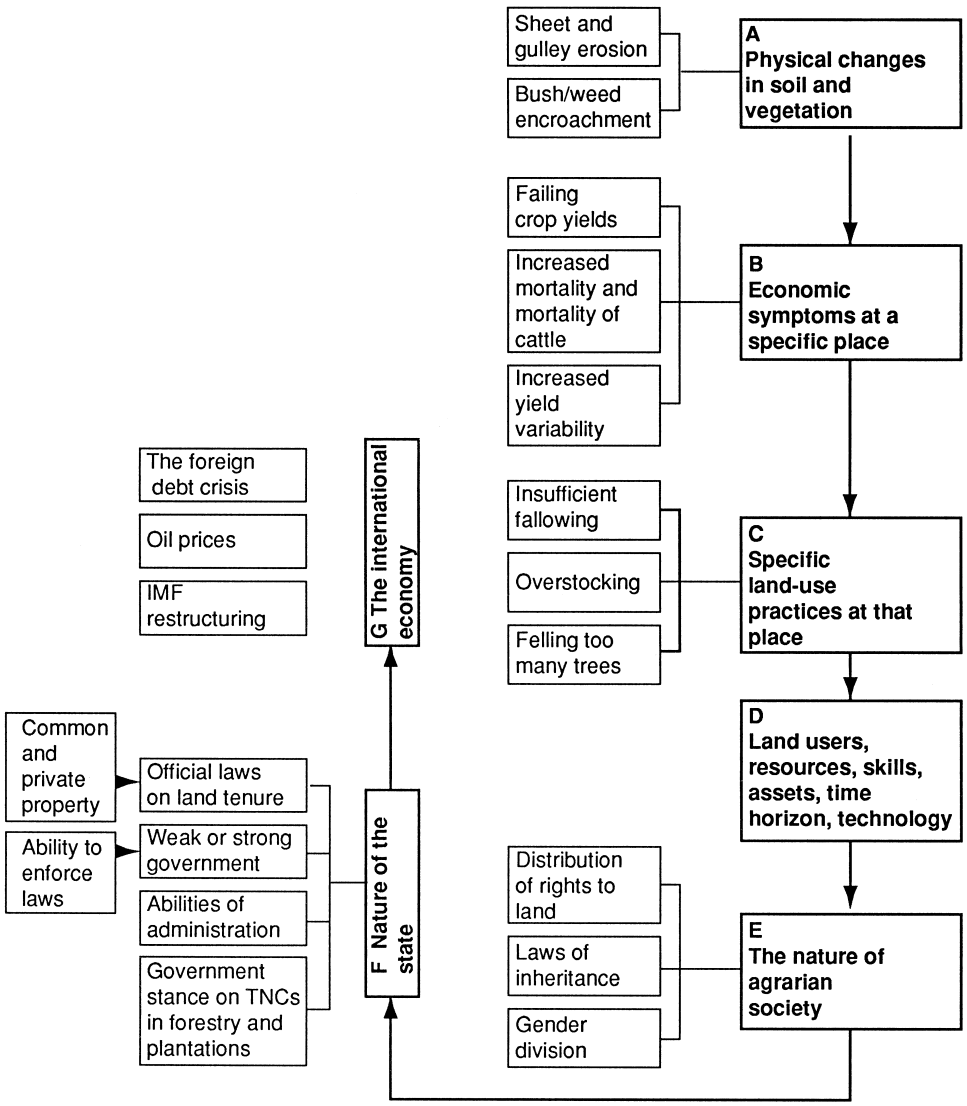

Figure 1 The chain of explanation in land degradation
Source: From Blaikie, 1995: 19, Figure 1.2

Table 1 Dimensions of a politicized environment

Dimensions	Physical changes	Nature of human impact	Political response	Key concept
Everyday	Soil erosion, deforestation, salinization	Cumulative and typically highly unequal; the poor are the main losers	Livelihood protests/ resistance	Marginality
Episodic	Flooding, high winds/storms, drought	May have general impact but unequal exposure means that the poor are the main losers	'Disaster' relief	Vulnerability
Systemic	Nuclear fallout, pesticide concentration, biologically modified species	Tends to have a general impact	Popular distrust of official 'experts'	Risk

Source: Adapted from Bryant and Bailey, 1997: 30, Table 2.1.

the one hand, and specific land-use practices at that place on the other hand, is 'open to uncertainty, both between scientists and between them and local resource users' (Blaikie, 1995: 20).

Another way in which to conceive of a politicized environment is to think in terms of the different dimensions of that environment (Bryant and Bailey, 1997). These dimensions are set out in Table 1 in relation to physical changes, the nature of the human impact, the political response and key concepts. The first 'everyday' dimension involves physical changes (e.g., deforestation, soil erosion) that simultaneously derive from day-to-day human practices and unequally affect those same practices on a daily basis (Blaikie, 1985; Peluso, 1992). While the human impact varies from place to place, there is usually none the less a process of marginalization at work which adversely affects the interests of the poorest members of the community. The second 'episodic' dimension includes physical changes (e.g., flooding, high winds/storms) that often have a massive, immediate and highly unequal human impact, but occur sporadically over time and are frequently described, usually inaccurately, as 'natural' disasters (Watts, 1983b; Blaikie *et al*., 1994). Here, the vulnerability of the marginalized poor needs to be emphasized. While a disaster may affect an entire community, it is typically the poor who are most exposed to its effects and least able to bear the associated costs in terms of disrupted livelihoods. The third 'systemic' dimension encompasses physical changes that derive from industrial activities (e.g., nuclear fallout, pesticides in the human food chain) which are potentially, but not necessarily, 'equal' in their human impact (Bull, 1982; Weir, 1988). The notion of a 'risk society' (Beck, 1992) may be useful in this context as a means to understand the general and unseen threats posed to humans as a result of selected human actions.

The field of third-world political ecology has thus built on earlier work in radical development geography and cultural ecology through its focus on the possible dynamics, properties and meaning of the notion of a politicized environment. Central to this task has been a concern to appreciate how that environment is constituted through struggles over material practices and struggles over meaning.

III Whose environment?

A more detailed understanding of the third world's politicized environment is to be found in the analysis of how unequal power relations are often linked to conflicts over access to, and the use of, diverse environmental resources. This type of analysis has long been a central theme in political ecology as scholars working in African, Asian and Latin American contexts have sought to explain questions of environmental control and contestation.

This research has almost inevitably required a historical perspective. The intervention of the European and American colonial powers in the 'third-world' is especially crucial to understanding contemporary patterns of human–environmental interaction and associated power relations. Such intervention encompassed the incorporation of third-world peoples and environments into a first world-dominated global system of capitalist production in a process in which millions of livelihoods were transformed often for the worse (Rush, 1991). Thus, a classic work by Watts (1983a) showed how the British authorities forced peasant producers in what is today northern Nigeria into an imperial economy, but in doing so left those producers exposed to the sharp vicissitudes of commodity prices in an economy hopelessly beyond their control. More recent work has linked the social and economic marginalization of farmers, shifting cultivators and hunter-gatherers explicitly to the propensity of colonial states to turn locally owned and operated 'commons' resources into state-run territories. The 'tragedy of enclosure' (Ecologist, 1993) has been described notably with reference to forest lands in south and south-east Asia (Guha, 1989; Peluso, 1992; Bryant,1997b) and rangelands in east and South Africa (Neumann, 1992; Peters, 1994).

As this research also shows, the colonial legacy is alive and well in many parts of the third world today where political and economic élites accumulate wealth and power based on tenure arrangements and management practices bequeathed to them by the departing colonial authorities (Bryant *et al*., 1993). In countries as politically, economically and culturally diverse as India, Burma and Indonesia, for instance, there has been a comparable tendency to affirm, whenever possible, the supremacy of a state-organized system of 'scientific forestry' that has served the political and economic interests of colonial and postcolonial regimes alike (Guha, 1989; Peluso, 1992; Jewitt, 1995a; Bryant 1997b). If anything, resource extraction has intensified in these and other third-world countries as a postcolonial quest for rapid national 'modernization' has been joined to concerns for individual or group enrichment and political ascendancy (Rush, 1991; Bryant and Bailey, 1997).

The political and ecological effects of this process are perhaps nowhere more evident than in the exploitation of Brazil's Amazonia. Here, to use Amado's compelling imagery that opened this article, the lands have been 'fertilized with blood' as a result of the development of a politicized environment described by political ecologists. Bunker (1985), Hall (1989), Hecht and Cockburn (1989) and Schmink and Wood (1992) provide rich empirical evidence from various parts of this vast region to show how political struggles, economic interests and ecological change come together in patterns of human–environment interaction that characterize Brazil's contemporary 'violent land' (Amado, 1989).

Social and economic inequities are an integral feature in the development of a politicized environment whether in Brazil of elsewhere in the third world. At a general level, research has emphasized the marginality and vulnerability of the poor *vis-à-vis* social and ecological processes. Yet certain disadvantaged groups have been more adversely affected than others; deprivation is not a uniform process. In the case of

indigenous people, for example, 'modern development' has often been associated with disrupted livelihoods, cultural genocide and the degradation of local environments (Hong, 1987; Hecht and Cockburn, 1989; Colchester, 1993; Howitt, 1996). The point of such work is not to perpetuate myths of indigenous people as 'wise stewards' of the environment, or to suggest that they are adverse to participation in the global economy (Murdoch and Clark, 1994; Harvey, 1996). Rather, it is to document the ways in which many indigenous people have been especially disadvantaged as their way of life is subverted by the spread of a development process outside their control.

Contemporary development processes and environmental management are also particularly prejudicial to the interests of poor women. Scholars adopting a 'feminist political ecology' perspective explore the nexus of politics, ecology, development and gender in order to clarify the diverse sources of female oppression and the multiple sites of women's resistance (Rocheleau *et al.*, 1996). This literature has moved on from the debates over essentialism that were prominent several years ago (e.g., Shiva, 1989; Agarwal, 1992; Jackson, 1993) to assess the ways in which gender may play a role in the construction of scientific knowledge, the distribution of environmental rights and responsibilities, and grassroots activism (Joekes *et al.*, 1995; Carney, 1996; Rocheleau *et al.*, 1996; Agarwal, 1997). This research shows that unequal power relations between men and women are reflected in, say, 'masculinist' research and policy-making agendas, the inequitable distribution of income-earning opportunities within households, and a general nonrecognition of women's household activities as 'work'. In the process, scholars demonstrate the gendered nature of the third world's politicized environment.

They have also sought to deepen our appreciation of how that politicized environment may be constituted at various scales. Reflecting political ecology's early links to anthropology (i.e., cultural ecology), the field is especially strong in local-level research that probes the meaning and significance of micropolitical struggles over environmental issues that often have national and global linkages (Ghai and Vivian, 1992; Friedmann and Rangan, 1993; Neumann and Schroeder, 1995; Peet and Watts, 1996b). Relatively less attention, in comparison, has been given to the political ecology of 'global' issues *per se*, and as seen from a third-world perspective (Moore *et al.*, 1996). None the less, work by Agarwal and Narain (1991), Mukherjee (1992) and Meyer-Abich (1993) on the politics of blame and 'agenda setting' surrounding the issue of global warming raises a series of questions in need of detailed exploration by political ecologists. In different ways, then, recent work emphasizes the multiscale nature of political ecology conflicts. Put differently, it shows how the politicized environment is constituted and changed at different scales in relation to both physical problems and actors (Bryant and Bailey, 1997). As Zimmerer (1994: 117) rightly observes, 'attention to multiple scales is now *de rigeur*; it is more explicit, more expected, and more expounded than heretofore'.

Running through most political-ecology research is the notion of social and environmental conditions constituted through unequal power relations. At one level, power is reflected in the ability of one actor to control the environment of another. Such control may be 'inscribed' in the environment through land, air or water alterations: felled forests, timber plantations, cotton fields, toxic waste dumps, mine tailings and so on. Resistance to such control may also become 'embedded' in the environmental 'text': forest clearance linked to 'illegal' cultivation or fuelwood gathering in reserved forests or national parks, the cultivation of forbidden crops or the poaching of big game in wildlife parks. Yet, if unequal power relations may be reflected in the physical environment in this manner, it is also clear that there is much more to those relations than 'meet the eye'.

IV Whose knowledge?

Research has focused in particular on the manner in which power relations may be reflected in conflicting perceptions, discourses and knowledge claims about development and ecological processes. Recent calls for a 'turn to discourse' in political ecology (Peet and Watts, 1996a) certainly reflect wider trends in the social sciences in the 1990s (Gandy, 1996). Yet these calls also reiterate an earlier point made by the political ecologists Schmink and Wood (1987: 51) that ideas are never innocent but 'either reinforce or challenge existing social and economic arrangements'.

Political and economic élites have invariably sought to justify specific, usually highly unequal, patterns of human use of the environment in terms of 'the greater social good'. Subordinate groups, in contrast, have typically challenged élites partly through the development of a 'culture of resistance' to élite claims (Scott, 1990; Peluso, 1992; Jarosz, 1996). Political ecological conflicts are thus as much struggles over meaning as they are battles over material practices.

The introduction of 'scientific forestry' in colonial Asia illustrates this point nicely. This German system of forest management was introduced first in British-ruled Burma and India and Dutch-ruled Java before being exported to other colonial territories in the late nineteenth and early twentieth centuries (Guha, 1989; Peluso, 1992; Jewitt, 1995a; Bryant, 1997b). The main purpose of scientific forestry was the promotion of long-term commercial timber production, especially key species such as deodar and teak, central to the imperial economies. But for this system to succeed, a major transformation in local social and ecological conditions was required. Hence, at the same time as imperial foresters sought to eliminate 'competitor species' to favoured tree species, they also attempted to restrict alternative forest practices that might 'interfere' with official timber extraction and regeneration operations – shifting cultivation usually being a favoured target (Gadgil and Guha, 1992; Peluso, 1992; Bryant, 1994; Jewitt, 1995a). Colonial officials justified the heavy-handed forest policing often associated with the imposition of scientific forestry on the grounds that it was a 'scientific' system that was introduced in the public interest. These officials further contrasted this 'ecologically good' system with the 'ecologically bad' practices of local forest users, notably shifting cultivators. A discourse of 'forestry as progress' was thereby developed in which 'appropriate' forest use was defined largely in terms of a commercial timber extraction, which was asserted to be both ecologically sound and financially remunerative to the state, while other local activities were denigrated (the 'destructive' shifting cultivator), marginalized (i.e., 'minor forest products') and even criminalized (Bryant, 1996). Yet, marginalized groups challenged the ascendancy of scientific forestry wherever it was introduced. They did so through resistance practices that simultaneously attacked imperial commercial interests, notably through arson attacks on timber plantations, and asserted pre-existing local use 'rights', through 'illegal' forest use (Guha, 1989; Peluso, 1992; Bryant, 1997b).

A related theme in political ecology is work on the social construction of environmental 'problems' and 'crises', and the ways in which this process may facilitate the control of peoples and environments by powerful actors. As Blaikie and Brookfield (1987) note generally, environmental problems are such only because they are seen as such by different individuals and groups. Environmental change becomes a 'problem' because it is seen to affect human interests adversely. Political ecologists have long observed that the human impact of environmental change is unevenly distributed in that poor and marginalized groups usually experience most forcefully its detrimental effects (Watts,

1983a). Yet the point here is a different one. It is, namely, that the process of problem definition, and associated plans for problem resolution, is itself a highly political act that may or may not be grounded in scientific 'fact'.

Discourses surrounding soil erosion and loss are illustrative in this regard. Early work by Anderson (1984), Beinart (1984), Blaikie (1985), Millington (1987) and Showers (1989) in various African settings showed how claims by colonial scientists that indigenous farmers were responsible for soil erosion were used by colonial officials to justify the imposition of a coercive system of soil 'conservation' in which farmers' land-use practices were closely regulated or the farmers themselves were required to move from especially 'threatened' areas (cf. Peluso, 1993; Neumann, 1996). These colonial discourses on soil erosion remain popular with many scholars and policy-makers even today with the result that poor farmers are often still blamed for soil-erosion 'crises' in many parts of the third world. In settings as diverse as Kenya, Bolivia, and Nepal, uncertain and ambiguous evidence is used to define soil-loss crises that are attributed, in turn, largely to peasant activities (Thompson and Warburton, 1986; Ives and Messerli, 1989; Tiffen *et al*., 1994; Rocheleau *et al*., 1995; Zimmerer, 1996; Guthman, 1997). As Guthman (1997: 45) notes, 'production of environmental interventions is intimately connected to the production of environmental knowledge, both of which are intrinsically bound up with power relations' (see also Neumann, 1997).

This sort of research provides useful insights into the ways in which environmental problems and crises may be socially constructed. The objective, however, is rarely to suggest that problems and crises do not exist (Rocheleau *et al*., 1995). Rather, it is to show how their selective identification and representation is a political process (Rigg and Stott, 1998). Indeed, this process of knowledge production reflects, and in turn often reinforces, social and economic inequities in so far as knowledge claims may be used (as seen above with regard to soil conservation programmes) as the basis of socially divisive public policy. In this regard, then, it is possible to argue that knowledge production and material practices are conjoined in such a manner as to perpetuate or generate environmental problems and even 'crises' for socially disadvantaged groups. To speak of these problems and crises is thus for political ecologists to consider the threatened livelihoods, linked to altered social and environmental conditions, that figure centrally in political-ecology thinking (Bryant and Bailey, 1997).

Consideration of the politics of knowledge leads almost inevitably into wider debates about the sociology of science. These broader debates have impinged on political ecology in several ways. Thus, it was noted earlier how feminist political ecology explores the gendered basis of environmental knowledge. A key theme in this work is to challenge the utility of a male-dominated and western instrumentalist science (Merchant, 1982). Issues addressed include the marginal role of women and women's interests in such science, its use to oppress women through the development process, the alleged objectivity and universality of western science, the inappropriate use of gendered metaphors in scientific work, and the dismissal of alternative scientific understandings based on women's experience (Shiva, 1989; Mies and Shiva, 1993; Joekes *et al*., 1995; Rocheleau *et al*., 1996).

A related set of issues concerns the status and possible contributions of 'indigenous' (or local) and western scientific knowledge to the specification and attempted resolution of various environmental problems. A number of scholars have emphasized, for instance, the politics surrounding the construction of research agendas in environmental science (Buttel *et al*., 1990). This may encompass the promotion of favoured research topics over those of rival scientists. Thus, for example, 'biodiversity' research was actively promoted

by the leading American biologist E.O. Wilson in an attempt 'to try and protect a specific academic interest (in whole organisms) from the radical reductionist currents in molecular biology then threatening to rule the roost' (Guyer and Richards, 1996: 5). Linked to such academic rivalry, of course, is the competition for scarce research funding. Moore *et al*. (1996) query in this vein whether the current boom in research on global environmental change reflects little more than the ability of scientists working in this area to play skilfully on public and official fears to maximize research income at the expense of other 'less pressing' areas of inquiry. Various scholars (e.g., Agarwal and Narain, 1991; Centre for Science and Environment, 1992; Mukherjee, 1992; Sachs, 1993), meanwhile, probe the links between western 'global' science, first-world efforts to blame the third world for global environmental problems, and the promotion of first-world controlled 'global' environmental management mechanisms.

A recurring theme in political ecology is the potential importance of 'indigenous knowledge' to environmental management issues. The general argument is that such knowledge is usually based on intimate and prolonged interaction with a given set of biophysical conditions, and that, as a result, local people in possession of that knowledge are often best placed to understand and regulate those conditions (Hong, 1987; Hurst, 1990; Banuri and Marglin, 1993; Colchester. 1993). While the merits of indigenous knowledge should not be exaggerated (cf. Murdoch and Clark, 1994), there is none the less a strong sense among political ecologists that it must be taken into account if efforts to resolve many local-level environmental problems are to bear fruit (Hecht and Cockburn, 1989; Hurst, 1990; Colchester, 1994; Gadgil and Guha, 1995; Jewitt, 1995b; Peluso, 1996). To this end, there has been increased attention of late to the promising idea of combining the 'best' of local and western scientific knowledge through 'hybridity' (Agrawal, 1995; Forsyth, 1996; Guyer and Richards, 1996). There are numerous methodological and epistemological hurdles to be overcome in the attempt to reconcile hitherto divergent discourses, but these efforts may yet bear fruit in the form of an integration of local and scientific understanding (Forsyth, 1996; Guyer and Richards, 1996; Zimmerer, 1996; Batterbury *et al*., 1997).

V Future directions

This article has suggested that political-ecological research has sought primarily to understand the political dynamics surrounding material and discursive struggles over the environment in the third world. If much work remains to be done in the topics discussed above, the research field as a whole also needs to be pushed in new directions hitherto at the margin of political ecology.

To begin with, political ecology needs to go beyond the 'land centrism' that has characterized most of the work done so far under its name. While land-based environmental problems ought to remain an important focus of research, attention none the less also needs to be devoted to the politics surrounding changes in air and water quality. It is indeed curious that, although water is 'essential material for maintaining bodily and social life', the political ecology of water quality and availability is still only in its infancy (Swyngedouw, 1995: 402). The same could also be said about the matter of changing air quality since the existing literature is largely devoid of political analysis (Hardoy *et al*., 1992; Setchell, 1995). Yet unequal power relations are as likely to be 'inscribed' in the air or the water as they are to be 'embedded' in the land.

There is also a great need for the development of what might be termed 'urban political ecology'. Notwithstanding rapid, if unequal rates of urbanization in many parts of Africa, Asia and Latin America in recent decades, political ecologists have yet to address this topic in a systematic fashion. Work notably by Douglass (1992) and Swyngedouw (1995; 1997) has begun to map the urban environmental implications of unequal power relations, but much more research is required before an adequate understanding is developed.

A further area in need of detailed study is that linking the organizational attributes of various actors to their capacity to act in political-ecological conflicts. By focusing their research largely at the local level, political ecologists have paid inadequate attention to the complex development traits and interests of different types of organizations except in so far as those traits and interests have manifested themselves at the specific location under study (Bryant and Bailey, 1997). Further, research that has sought to incorporate questions of organizational structure has been focused largely on the role of the state (e.g., Bunker, 1985; Hecht and Cockburn, 1989; Peluso, 1992; Rangan, 1997). Very little comparable work has been undertaken in the field on nonstate actors such as businesses, multilateral institutions, nongovernmental organizations or local-level people's organizations.

Finally, another area in need of research relates to the human body itself. In a thought-provoking article, Mayer (1996: 441) has recently noted that 'seldom has the political ecologic framework been used to understand patterns of health and disease'. He argues for a coming together of research in political ecology and medical geography so as to obtain a better picture of how unequal power relations may be reflected in patterns of human health, disease and mortality (Mayer, 1996).

Political ecology thus looks set to move in exciting new directions at the same time as it deepens its understanding of the material and discursive practices that have long been its stock in trade, and which are central to any adequate understanding of human–environmental interaction. As scholars better appreciate the properties and dynamics of the politicized environment, they may also be well placed to suggest new ways in which to change that environment in keeping with goals of social justice and equity. Indeed, perhaps one day, even the 'violent lands' will become peaceful.

Acknowledgement

I wish to thank Professor Philip Stott for his constructive comments on an earlier version of this article.

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