Ontology Matters: The Relational Materiality of Nature and Agro-Food Studies

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This paper has two widely separate points of departure; hopefully these beginnings become less obtrusive as the discussion unfolds. These origins include a response, now very oblique it must be said, to Terry Marsden's comments (Marsden 2000) and, second, exploratory reading with the quixotic aim of finding common ground between labour process perspectives and actor-network theory (ANT) in the analysis of agricultural biotechnologies. This integrative quest remains as distant as ever, but Marsden's proper insistence on the importance of middle-level concepts prompted me to interrogate these tools in agro-food studies. These disparate origins explain the awkward juxtaposition of reflections on the labour process, a key meso-level concept in the development of agro-food studies, and heterogeneously engineered actor-networks, an ontological construct of quite a different stripe.

However, there is an intersection of sorts, as this awkward pairing emphasizes that our ontological choices are consequential, determining analytical points of entry, arenas of theory and praxis, and normative positioning. Previous papers have argued that the question of ontological choice has not been confronted explicitly in agro-food studies, which remain rooted in the dualist ontology shared with orthodox social science (FitzSimmons and Goodman 1998; Goodman 1999). Eradication of this silent collusion with the modernist antinomy between nature and society, it was further argued, would equip agro-food studies to engage more coherently in the new political spaces being carved out by the 'green' ethics and relational ethos of bio-political movements, including environmental organizations, animal welfare groups, and food activists.

These political spaces have widened significantly in the past two or three years, riding the extraordinary wave of bio-political activism provoked by the accelerating innovation and diffusion of agro-biotechnologies. International in scope, this mobilization has ranged from the attempted destruction of field testing sites and genetically modified crops, with numerous arrests and court hearings, to street demonstrations against the WTO agricultural trade and intellectual property regime and multilateral financial institutions in Seattle, Zurich, Washington DC and, most recently, Prague. The release of genetically modified organisms (GMOs) has been critical in galvanizing and focusing these protests but more deep-seated misgivings

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also have surfaced about the structural concentration, homogenizing forces, and lax regulation of globalizing agro-food systems. The remarkable international projection of José Bové, the self-appointed scourge of transnationalized *mal bouffe* and guardian of local, handicraft food traditions, which followed the depradation of a McDonalds restaurant in Millau, is an isolated but expressive example of this disquiet in Western Europe in the aftermath of 'mad cow disease,' more sporadic food 'scares,' and abrasive US-EU trade disputes over growth hormones in beef.

Bio-political activism and public mistrust engendered by agro-biotechnologies encompass ethical objections to the engineered transgression of species boundaries, fears about the irreversibility of gene flow from genetically modified crops into weedy relatives and less managed ecosystems, and the possible health risks of genetically modified foods. Hence the recent assurances by major British supermarkets that their product lines are 'GMO-free.' In the absence of widely accessible institutional avenues of participative democratic debate on technological change and with widespread skepticism, especially in Western Europe, about the independence of scientific advice and the regulatory process, there is a growing perception that GMOs are being incorporated by stealth into foods and bodies to serve the interests of a handful of transnational 'life science' companies.

This potent mix of ethical, environmental and food safety issues has dominated the recent bio-politics of agricultural technoscience. By contrast, the bleak portents of agro-biotechnologies for rural social structures and the iconic 'family farm,' including the possible dramatic extension of contract production, have yet to receive much attention in public debates. Yet, oddly enough, it is precisely these questions which the inherited theoretical framework of agro-food studies is designed to pursue, since the relations and forces of production and work-based struggles are ontologically central. Despite the unquestionable significance of farm structure issues, however, the effervescent bio-politics of agro-biotechnologies present new challenges for agro-food studies, its conceptual armoury and praxis. Meeting these challenges means giving more explicit attention to the transformations these technologies foreshadow in the *relational* materialities and socialities of ecologies and bodies. This demands a new analytical engagement with the materiality of nature; that is, as an ontologically real and active, lively presence (Benton 1989; Castree 1995). As we have argued previously, this task must begin with the modernist ontological legacy of agro-food studies and its inability to deal conceptually with the liveliness of nature, its relational properties, and what Marsden et al. (2000), following Beck (1992), call its 'boomerang' qualities, exemplified most recently by mad cow disease.

Engagement with the lively materiality of nature in agro-food studies has been tenuous, at best. The main theoretical currents in the field, perhaps fearful of the taint of biological determinism, have been reluctant to acknowledge nature as an active, relational presence in the eco-social co-productions of agro-food networks. Ignoring substantive discussions in other social theoretic fields, agro-food studies has largely failed to theorize the place of nature, typically giving only a cursory nod to its 'biological character and rhythms' on the widely-held, but only fitfully interrogated, premise that such 'peculiarities' lack analytical significance.

This failure to engage theoretically with 'the status of nature' (Mardsen et al. 2000) possibly can be attributed to the further implicit assumption that nature's materiality is 'covered' by the metabolic relations of the agricultural labour process.

This dispensation seems to hold whether this lively presence, following Worster (1990), is conceptualized as a benevolently active partner or as the capricious, revengeful 'howling world of nature' of the US Dust Bowl. Certainly the labour process has strong claims to be the foundational meso-level concept of the 'new' rural sociology and political economy that has defined agro-food studies since the 1970s. Furthermore, as we see in the next section, the labour process is the lynchpin of the conceptual armatures developed in this field to analyze agricultural biotechnologies.

The assumption that the materialism of the labour process can be taken for granted also implies that we are dealing with an unambiguous, unitary concept. This neglects the changing emphases given to naturalist and materialist premises in Marx and Engels' philosophical writings and in their economic theory (Benton 1989), and the different conceptualizations of the labour process, which have descended from this complex and disputed classical heritage. The concept of the labour process articulated in agro-food studies arguably is descended from the Leninist position, which gave no specific analytical status to nature (Goodman, Sorj and Wilkinson 1987), rather than alternative, more explicitly naturalist and materialist lineages.

These varying classical currents and their exegesis also inform contemporary debates on the 'greening' of social theory, the disputed equation of humanism and speciesism, and Red–Green exchanges, which problematize *inter alia* the ontology of Marxian political economy and its Promethean inflections. Broadly speaking, these exchanges on the 'greening' of Marxism turn on the necessity of ecological reconstruction (Benton 1989, 1992; Grundmann 1991; O'Connor 1988, 1998; Watts 1995; Burkett 1998a,b) or, conversely, its possibility (cf. Benton 1993; Hayward 1995; Soper 1995; Dickens 1996; O'Neill 1994). Surprisingly, these themes have found virtually no resonance in agro-food studies (FitzSimmons and Goodman 1998).

In this paper, we draw attention to the ontological choices and associated political agendas, which underlie different theoretical perspectives. These questions are explored in agro-food studies by examining the privileged place of the labour process in the development of the field and, as a more specific illustration, in analyses of agro-biotechnology. It is suggested that the ontological priorities embedded in the unreconstructed conceptualization of the labour process not only have been ignored but also have found an unexamined place in post-structuralist agrarian political economy. We also review the strength and weaknesses of ANT as an alternative avenue of critical engagement with the 'new' bio-politics of agro-food networks. This discussion is not intended to issue in claims of epistemic privilege. Rather, its purpose is to evoke greater awareness of our inherited conceptual framework and encourage theoretical renewal to support progressive currents in the new political spaces opened up by bio-political activism.

The labour process and agro-food studies

This section briefly reviews the central role of the labour process as the meso-level concept *par excellence* in the analysis of agrarian change in advanced industrial countries. This centrality reflects the twin foundations of the 'new rural sociology' and 'new political economy of agriculture' in the deductive epistemology of classical Marxism, which was not seriously questioned until the later 1980s (Long et al. 1986; Vandergeest 1988; Marsden 1988; Buttel and Goodman 1989; Buttel

and McMichael 1990), and in a production-centred analysis of agrarian social relations. The labour process embedded in this analysis did not privilege human interaction with the material conditions of agricultural nature, as in Marxian naturalistic formulations where, for example, "Nature is man's *inorganic* body." Rather, the labour process concept widely adopted in the 'new' rural sociology, and which posits the mimetic equivalence of agriculture and industry, derives from the politically charged context of Lenin's debates with the Narodniks and Kautsky's exchanges with the German 'reformists' (Hussein and Tribe 1981). Although the subtleties of Kautsky's analysis more recently have been reclaimed from the Leninist orthodoxy (Watts 1996; Goodman and Watts 1997), "the Russian, and specifically Leninist, contribution . . . (came) . . . to define the terms of the 'classical' debate, overshadowing the more nuanced German analyses of the same period" (Goodman et al 1987, p. 145). This lineage of theoretical and macrostructural concerns was further strengthened by re-interpretations of the classical tradition, and notably the 'agrarian question,' in the neo-Marxist development literature on the fate of the Third World peasantries, including debates on the articulation of modes of production, modernization theory and green revolution technologies, and commoditization processes (Newby 1985).

These infusions marked the epistemological rupture with the micro-analytic orthodoxy of rural sociology and agricultural economics, imparting theoretical direction and vitality to the emerging young field. As already suggested, the recovery of the deductivist legacy of classical Marxism also extended to its central problematic: the capitalist transformation of agrarian social structures (Goodman and Redclift 1981; Buttel and McMichael 1990). This theoretical framing, with its corollary of social and technical relations of agricultural production as the object of analysis, has dominated the 'new political economy of agriculture,' including recent debates on theoretical trajectories to escape structural determinism. Its imprint as foil can clearly be seen in critical moves to formulate actor-oriented perspectives of agrarian change (Long et al. 1986). Furthermore, even as the field grapples with such new concepts as 'global agro-food restructuring,' the analytical importance of social differentiation processes at the 'point of production' is re-asserted as part of efforts to de-mystify the global.

In the 1980s, the strong continuities of 'agrarian question' problematics and deductivist methodology can be traced through the shifting terrain of discussion variously encompassing the 'paths' of capitalist penetration, the 'survival' of family-labour farms, small commodity production and its formal/real subsumption to capital. The immediate farm-level social and technical relations of production similarly are privileged in analyses of agrarian exceptionalism, that is, agriculture as a special case or anomaly within capitalism, arising from the singularities of its natural production process (Mann and Dickenson 1978; Goodman et al. 1987; Mann 1990).

The theoretical legacy of the 'agrarian question' also has provided the conceptual foundations for the analysis of *filières*, commodity systems, and the notion of agro-industrial complexes, which were formulated separately in the French, U.S., and Latin American literatures in the later 1970s and early 1980s. These modes of analyzing social organizational change in agricultural production are grounded unequivocally in the concept of the labour process. Thus Friedland et al. (1981) declaim the previous neglect of this concept in rural sociology (ibid, p. 29), while van der Ploeg (1986, p. 27) identifies its "inadequate treatment" as a major weakness of commoditization theory.

Despite declarations of a methodological break with deductivist perspectives, the labour process nevertheless remains a key organizing concept in agro-food studies, now somehow detached from its wider theoretical moorings, which conveniently go unacknowledged. Thus it continues to be used to bridge or characterize the 'middle ground' between heterogeneous production units and larger spatial scales. Recourse to the conceptual frame of the labour process can be tracked across analyses of capitalist restructuring, the characterization of Fordist/post-Fordist production in agriculture, 'farming styles' actor-oriented perspectives, and the food regimes literature (Goodman and Watts 1994).

Arguments for the 'new' internationalization of agriculture and global agro-food complexes build heavily on reformulations of commodity chain perspectives to conceptualize regional divisions of agricultural labour integrated in spatially extended production systems involving global sourcing (Sanderson 1986; Raynolds et al. 1993; Bonnano et al. 1994; Goodman 1997). Buttel (1996) suggests that global agricultural commodity systems, chains and complexes are concepts that "represent the emerging scholarly tradition, or traditions, of 'global agro-food restructuring'" (p. 17). Following Whatmore (1994) and Arce and Marsden (1993), Buttel supports the admonition to "devote more attention to farm- and farm household level dynamics" in order to avoid "the tendency of studies of global agro-food complexes . . ." to "succumb to structural determinism" (Buttel 1996, p. 33). Interestingly, the earlier tradition of agro-food commodity chain research, now complemented by the notion of 'systems of provision' (Fine and Leopold 1993), is being renewed by the consumption 'turn' in social science, notably in geography (Cook and Crang 1996; Leslie and Reimer 1999; Hartwick 1998; Dixon 1999).

This inevitably cursory review makes the point that the concept of labour process, a corner-stone of Marxist political economy, has been an important element in shaping the main strands of analytical thought in agro-food studies, from the 'agrarian question' problematics of the 1980s to the global agro-food restructuring debates in the 1990s. On one level, this observation is trivial, particularly since the purpose here is not to claim conceptual hegemony for the labour process but rather to note continuities in its use. Such continuities become more troublesome, however, in light of assertions that new analytical approaches in agro-food studies centred, for example, on 'contextualized human agency' (Arce and Marsden 1993) and actor-oriented formulations (van der Ploeg 1993), have transcended the weaknesses and limitations of the putatively structuralist political economy in which the labour process is so deeply embedded. To the best of my knowledge, agro-food studies has made no attempt to disembed this concept from its original theoretical framework nor to examine the ontological implications of these roots. As a case in point, we turn now to the use of the labour process framework in studies of agricultural biotechnologies.

The labour process and agricultural biotechnologies.

What may be termed 'first generation' analyses of agricultural biotechnologies extended the horizon of agro-food studies by problematizing the boundaries between 'agriculture' and 'industry' (Kloppenburg, Jr. 1988; Goodman, Sorj and Wilkinson 1987). This analytic move provided the basis for wider, more systemic and historically grounded studies of agro-industrial development by emphasizing

the contingency of this division of labour. However, although these 'first generation' approaches revealed promising new lines of analysis, the problematics of agricultural technoscience continued to be framed in the distinctly classical terms of capitalist penetration and commodification of the agricultural labour process. On the presumption that the transformative contradictions between the forces and relations of production would unfold on this site, the labour process provided a privileged standpoint for critical social science to view the societal implications of technological change. With the multidimensionality of recent bio-political activism, a labour process framing of agricultural biotechnologies now seems unnecessarily restrictive.

The work of Kloppenburg, Jr. (1988), for example, is first situated generally on the classical Marxist terrain of agriculture as a 'recalcitrant sector,' before taking up the specific theme of the vectors of capitalist penetration of plant science and its gradual reconfiguration as "capitalist property" (Braverman 1976, p. 156). The commodification of the seed is conceptualized as a process of primitive accumulation, whose highlights are the innovation of hybridization, politically driven shifts in the institutional division of labour between public and private plant-breeding, and changes in intellectual property rights to facilitate the private appropriation of plant genetic resources. Kloppenburg's (1988) purpose is to explain how the seed, ". . .which is perhaps the element of agricultural means of production most central to the entire farm production process . . ." (p. 39), is commodified and becomes a capitalist force of production. Agricultural biotechnologies are emblematic of this historical trajectory since "what is now occurring in the seed sector is one instance of a much broader technological transformation that is galvanizing changes in the social organization of all production processes in which organic substances or life forms play a significant role" (Kloppenburg, Jr. 1988, p. 193).

Goodman, Sorj and Wilkinson (1987) apply the commodification approach to on-farm means of production more generally (implements, motive power, nutrient cycles, pest control, seeds, energy) and posit that the biophysical processes of agricultural production and food consumption have constituted natural, though historically contingent, constraints to the industrialization of agricultural use-values. Unable to reproduce natural production processes fully by direct transformation, industrial capitals have adapted in singular ways to the sectorally differentiated properties of agricultural nature (biological time, photosynthesis, land, climate) and the physiology of human nutrition. These differences, it is argued, are analytically significant as a major source of variation in the historical dynamics, specificities and contemporary configurations of social production in agro-food commodity networks. The concept of 'appropriationism' is used to designate the historically discontinuous, piecemeal ". . . but persistent undermining of discrete elements of the agricultural production process, their transformation into industrial activities, and their re-incorporation into agriculture as inputs . . ."(Goodman et al 1987, p. 2). Elements of natural production processes are progressively internalized via proprietary science and technology as individual sectors of accumulation and reproduction of industrial capitals.

In common with Kloppenburg, Jr. (1988), these authors recognize the pivotal importance of hybridization in opening up opportunities for proprietary plant improvement and promoting the convergence of mechanical, chemical, and genetic innovations in integrated crop management systems, subsequently internationalized as Green Revolution technology 'packages.' Thus ". . . the seed is the bearer

of technical progress in plant biology and this discipline, reinforced by the new biochemical and molecular genetics of the 1950s and 1960s, has emerged as the privileged locus of industrial appropriation" (Goodman, Sorj, and Wilkinson 1987, p. 37). In brief, in agriculture, where industrial capitals confront a natural production process, agricultural biotechnologies constitute "a generalised advance in the capacity of industrial capitals to manipulate nature" (ibid, p. 98).

In a recent critique and extension of these 'first generation' analyses, and including Susan Mann's work (Mann and Dickenson 1978; Mann 1990), Boyd et al. (2000) borrow from Marx's value theory to propose a distinction between the formal and real subsumption of nature. The latter concept can be applied only to those 'nature-based industries' governed by the 'logic of cultivation,' where biophysical properties and processes can be "*engaged and mobilised* in the production process" (ibid, p. 16, original emphasis). More specifically, "under real subsumption, capital circulates through nature (albeit unevenly), as opposed to *around* it" (ibid, p. 22, original emphasis). For Boyd et al. (2000), "manipulation of the genetic program" is both paradigmatic of real subsumption and its primary mode of expression because it draws attention to the "more general tendency" whereby nature is made to act as a force of production (p. 26). Here, Boyd et al. (2000) stress the continuities of this process and view the "new biotechnologies as a new round in the expansion and intensification of both real subsumption and appropriationism" (pp. 23–24).

With their insistent emphasis on the social agency of capital in *making* nature into a productive force, Boyd et al. (2000) echo a much earlier formulation by Yoxen (1981). His seminal, though neglected, contribution is closely linked to the now equally neglected work of the Radical Science Journal Collective, and its commitment to critical praxis and the agitational potential of de-mystifying science and technology (RSJ 1981). Behind its banner of "science as labour process," the Collective attacked the purified categories of 'science' and 'society' to demonstrate that capitalist social relations are imbricated in both the scientific labour process *per se* and the social intentionality of control, exploitation and valorization, which informs the *design* of technology and labour processes. This "science as labour process" current in early science and technology studies drew on debates in the Conference of Socialist Economists in the U.K. which, in turn, were influenced by Continental Marxist theory and praxis and Braverman's *Labour and Monopoly Capital* (RSJ 1978,1981; Young 1979).

Braverman's influential treatment of the role of science as capitalist property in the labour process, also underpins Kloppenburg's analysis of the development of plant science as a "transformative force in agriculture" (Kloppenburg, Jr. 1988), as noted earlier. However, due to the "relatively underdeveloped" state of biology, "the parent discipline of the agricultural sciences" (p. 35), this transition did not occur until the 1930s.

The subsequent accelerated development of biology, and specifically the mutually constitutive movement between the knowledge-making practices of molecular biology and its institutionalization and control by capital, are the central concerns of Yoxen (1981). In contributing to a critical oppositional strategy, he examines "the history of molecular biology as a research programme and as a technological project – formed, organized and regulated by political forces" (p. 67). However, the "system of control of biology by capital" which emerged did so "without the farsighted prediction or prevision of that as an eventual goal" (ibid, p. 67). Yoxen's principal analytical themes are the following: the emergence of the reductive, 'information'

theoretic view and the forces behind "the apprehension of nature as programmed matter" (pp. 69–71); the co-extensive but indirect processes of incorporation and "highly mediated control" of molecular biology by capital, "exercised by private, corporation-based foundations, the State, and industry" (p. 73) and, thirdly, the struggle between alternative 'ideologies of practice' about "how to do biology" (pp. 75–77).

This penetrating analysis of the origins of biotechnology concludes by noting the profound implications of the re-definition of life arising from the extension of intellectual property rights to 'new' life forms and their consequent commodification. Under the control of capital, biotechnology "is a specific mode of the appropriation of living nature – literally capitalising life," which ". . . becomes a productive force, playing a growing role in reconstituting the social relations of a new capitalist order" (Yoxen 1981, p. 112).

The labour process framework adopted by these 'first generation' approaches clearly privileges human praxis in drawing out the socio-political ramifications of the capitalist appropriation of the seed and plant breeding. This provides an incisive analytical vantage point to address social *cui bono* questions and rural social structures as nature is reconfigured as a productive force, which can be directly manipulated according to the dictates of the market. These analyses also de-mystify science and technology by focusing on the processes of their commodification and embeddedness in capitalist social relations.

It is equally clear, however, that agency in these approaches is unidirectional and uniquely identified with human intentionality and praxis. Human agents act 'upon' an external, objectified, but now less 'recalcitrant,' nature, rather than in social partnership with nature. Perspectives founded on this instrumentalist ontological position, with its purified categories of nature and society, offer no theorization of the lively entities emerging in these technoscientific practices, nor entertain non-human perspectives or shared consequences. However, although this theoretical silence was shattered long ago in the sociology of scientific knowledge, these developments only recently have begun to penetrate agro-food studies, as we see below.

The materiality of nature: reconstructing the labour process

The preceding discussion reveals the importance of the labour process, a core concept of 'structuralist' political economy, in many formative debates in agro-food studies and analyses of agricultural science and technology. While its parent theoretical framework has been widely disowned, the labour process nevertheless has retained its salience as a meso-level concept in recent analyses of agrarian restructuring, global agro-food complexes, and commodity chains, as already discussed. Among other things, the labour process serves to 'ground' these approaches by providing conceptual space for contingency, difference, heterogeneity and regional variation (cf. van der Ploeg 1986, 1993; Whatmore 1994). Furthermore, the labour process furnishes agro-food studies with theoretical linkages to critical social sciences and shared rules of engagement for dealing with mainstream questions of exploitation, gender, power, resistance, social justice and collective action.

However, such connections carry seldom acknowledged consequences since labour process perspectives give theoretical primacy to production, which frames the questions asked and shapes the content of politics. Loosely paraphrasing Hall (1986), this means that theoretical entry is gained through the gateway of produc-

tion, which situates the observer at a particular location in the circuits of capital. Of course, this location may be preferred as a fruitful terrain of theory and praxis, as in the case of the Radical Science Journal Collective, for example. However, the implications of this 'standpoint' for the analysis of nature–society interactions and bio-political praxis have not received the attention they deserve in agro-food studies.

We have suggested that agro-food studies by the early 1990s conveyed the impression, in word if not in deed, that it had 'settled accounts' with deductivist theoretical perspectives and was taking up new analytical challenges (Buttel and McMichael 1990; Arce and Marsden 1993). However, this shift seems to have been more about problematics, especially of the 'agrarian question' variety, than a root-and-branch interrogation of its ontological foundations and core concepts. This paradox is all the stronger in view of the theoretical ferment in parallel literatures, including debates on the reconciliation of Red/Green perspectives, the ecological reconstruction of Marxism, the re-assertion of nature's agency in the 'new' environmental history, and trans-disciplinary efforts to bring nature 'back in' to social theory (FitzSimmons and Goodman 1998). By problematizing the modern ontology of the social sciences with its dualistic separation of nature and society, these initiatives interrogate the ability of inherited conceptual structures to address the materiality of nature–society interactions (Benton 1991, 1995). Moreover, this interrogation can be extended to conceptualize the materality of nature as an active, lively, constitutive, and relational presence, rather than only as metabolism.

In this context, the lack of a systematic Marxist theory of nature has become a fertile source of exegetical disputes. This challenge, initiated by Alfred Schmidt's classic study, *The Concept of Nature in Marx* (1971) has encouraged theorists to resuscitate the naturalistic, materialist premises of Marx's early writings as the foundations of an ecological Marxism. Much of this reclamation work, disputed by fellow Marxists[1] and green social theorists[2] alike, has centred on the labour process as the locus of metabolic activity between society and nature. As observed previously, points of discussion include the Prometheanism of Marx's conceptualization, the related rejection of 'natural limits' arguments, and under-theorization of 'the ecological crisis-tendencies of capitalism' arising from the destruction of its conditions of production and reproduction, the so-called second contradiction of capitalism (Benton 1989, 1992; Grundmann 1991; Watts 1995; O'Connor 1988; Burkett 1998a,b).

This expanding programme to construct an ecological Marxism and integrate Red/Green concerns also has been taken up in Marxist geography, where Castree (1995) has sought to extend the 'production of nature' thesis (Smith 1984) and subsequent debates (Redclift 1987; FitzSimmons 1989 a,b). Here, Castree (1995) welcomes recent efforts to "re-discover nature's materiality in Marx" (p. 21) and finds that Benton's "attempt to 'green' Marx is especially lucid" (p. 22), including his proposed reconstruction of the labour process both in its abstract formulation "as a trans-historical aspect of all societies, and his account of the labour process under capitalism specifically" (p. 22–23). To summarize drastically, Benton's purpose *vis-á-vis* both Marx's 'mature' economic theory and contemporary labour-process debates originating from Braverman (1974) is to ensure that the complex duality of labour processes is recognized. That is, to complement the social-relational aspects of exploitation and valorization by restoring to equal prominence the second aspect of labour processes as forms of social appropriation of nature (Benton 1989).

For its advocates, the promise of this new perspective is that questions of social justice and environmental justice can be jointly theorized and politically engaged, staking out ground for a Red/Green *rapprochement*. In this respect, Castree (1995) envisions ecological Marxism as the analytical thread for an ecological socialist politics linking local, place-based environmental struggles into a wider political project, anticipating Harvey's call to find ways to connect 'militant particularism' and global ambition (Harvey 1996).

Agro-food studies has remained oblivious of these debates and reconstructive proposals. There is equal indifference, it would seem, to the primacy of the social-relational aspect of labour-process theory, on the one hand, and the reconstructive case that some reformulation is necessary to take account of the materiality of nature, on the other. To cite Castree (1995) slightly out of context, such work is imperative if nature is to be taken "seriously as a material entity and actor in history, without hypostatizing it *as a fixed, unchangeable, universal given separate from society*" (p. 25, my emphasis).

To spell out the disturbing corollary of this argument, reliance on the unreconstructed concept of the labour process involves, at the very least, complicit (because unexamined) acceptance of the modernist separation of nature and society, and the corresponding incapacity to theorize the active materiality of nature. Given the primacy of social-relational aspects in Marx's economic theoretic formulation, our present conceptual categories give inadequate theoretical purchase on the lively eco-social coproductions of agro-food networks. It is particularly encouraging, therefore, to see the growing engagement in agro-food studies with theories which urge that 'the status of nature,' as Marsden et al. (2000) put it, be reconsidered. This reflexive 'turn' to give analytical salience to nature includes work on consumption and food quality (Lockie and Kitto 2000), and parallel explorations of ANT (Busch and Juska 1997; Murdoch 1997a,b; Whatmore 1997; Goodman 1999), convention theory (Wilkinson 1997; Murdoch and Miele 1999) and, most recently, of complementarities between these two perspectives (Marsden et al. 2000).

Such reflexive consideration of nature as an active, relational entity is long overdue. However, the magnitude of the task needed to unearth the reductionist ontology so deeply embedded in the sociological framework of agro-food studies should not be under-estimated. As Benton (1994) observes more generally about this foundational framework, ". . . this weakness of sociology is more than a contingent fact about the research interests of its practitioners. Rather, the conceptual structure or 'disciplinary matrix' by which sociology came to define itself . . . effectively excluded or forced to the margins of the discipline . . . questions about relations between society and its 'natural' or 'material' substrate" (p. 29). Benton continues, ". . . these dualistic modes of thought go very deep. They are not mere superficial devices which can simply be eliminated from the discipline whilst leaving everything else in place. They are in a very important respect *organizing* categories . . . shaping sociological thought and research across the whole span of the discipline . . ." (p. 29, original emphasis).

Actor-Network Theory and relational materialism

What might be termed the internal path of reconstruction, as taken by Benton (1987, 1992, 1993), O'Connor (1998) and others in ecological Marxism, so far has been spurned by the incipient reflexive 'turn' to bring nature 'back in' to agro-food studies. In this field, the ontological and epistemological limitations of the inher-

ited political economic framework essentially have been evaded by taking up new theoretical perspectives and conceptual repertoires. In some cases, these ontological shortcomings and their political consequences are uppermost in such explorations. In other cases, ontological critique is more muted or only implicit, and new theoretical resources are now deemed necessary because certain issues, such as the contemporary food safety-quality-nature nexus, "are not easily rendered into the vocabulary of political economy" (Marsden et al. 2000, p. 112).

The move towards new theoretical perspectives rather than undertaking renewal *from within* the political economy paradigm also has much to do, it would seem, not only with the ontological abstraction of nature, but the way in which it is 'seen' and metaphorically framed. Thus, Benton (1987), for example, calls for renewed emphasis in Marxist political economy on nature as physical limits, as "the nature-given material conditions" (p. 54) of human social life. Analytical entry to nature–society interactions is gained through the lens of social agency, material necessity, and constraint, which frame the passive, albeit dialectical, dimensions of nature. In contrast, perhaps because category fusions are so patently in play in agro-food studies, contributors seeking to raise the salience of nature have been drawn to post-structuralist perspectives, notably ANT, which focus on the relational materiality of non-human entities and their active, lively properties.[3] Scholars are attracted to ANT, for example, by its integrative, symmetrical lexicon and powerful metaphoric tools. In view of the many expositions of ANT, this discussion will focus mainly on what this perspective brings to the analysis of the relational materiality of nature.

ANT elaborates a set of heuristic concepts and methodological premises to propose that ontological categories, such as nature/society or structure/agency, cannot be theorized and defined *a priori*. Rather, these categories have variable geometries and are only discernible *ex post* as the collective, processual 'effects' of translation networks engineered from heterogeneous materials and entities, both human and non-human. With this precept and its companion methodological principle of 'generalized symmetry,' the analytical challenge is to conceptualize and describe the process of network formation in terms of the *constitutive* exchange of properties across the nature/society divide between these entities. Networks are built by variable associations of human and non-human actors and intermediaries in processes of heterogeneous engineering. These heterogeneous associations or collectives of the 'natural' and the 'social' hold these domains together and constitute the inextricably sociomaterial terrain of agency. In this heterogeneous engineering, no line is drawn *a priori* between classes of phenomena "by distinguishing those that drive from those that are driven" (Law 1994, p. 12). In other words, such 'purified' categories as 'nature' and 'society' or 'structure' and 'agency' are *outcomes* of network-building processes. Accordingly, since these categories are emergent, ANT denies them *a priori* causal significance.

In rejecting the purified or fetishized categories of 'nature' and 'society,' Latour (1994) focuses on "the blind spot where society and matter exchange properties" (p. 41). A central analytical move is to bring these transactions into full view in order to expose the inescapable sociomateriality of the entities mobilized into the heterogeneous associations which construct, stabilize and extend our world. The constant interchange of human and non-human properties in network formation has created ". . . mixtures between two entirely new types of being, hybrids of nature and culture" (Latour 1993, p. 10). In these processes of mediation, the natural and social worlds have been woven into "a seamless fabric."

In his historical exploration of sociomaterial collectives, Latour (1994) analyses their increasing complexity by reference to the strata laid down by human/nature interactions. These layers mark the endless crossovers or exchange of properties, progressively blurring "the distinction between social actors and objects" (54). This stratigraphy reveals the accelerating "socialisation of non-humans," manifested by the "congealed" heterogeneous engineering "... of absent makers who are remote in time and space yet simultaneously active and present" (Latour 1994, p. 40).[4] These "technical delegates" of past sociomaterial interactions, earlier outcomes of the "delicate shuttle" of relational networking across the nature/society 'divide,' hold society together and provide the foundation for modern technosciences. These "multiply the non-humans enrolled in the manufacturing of collectives and ... make the community that we form with these beings a more intimate one" (Latour 1993, p. 108).

This brief overview reveals how ANT ties together the material and the social in ways which transcend the modernist divides, and compels us to interrogate notions that ". . . localise agency as singularity – usually singularity in the form of human bodies" (Callon and Law 1995, p. 502). In other words, ANT goes beyond attentiveness to the material foundation of human action. Its premise is that agency is always a collective, networked outcome, performed by nondualist sociomaterial associations. In this relational and processual conceptualization, non-humans are actively present and consequential.

ANT makes the radical claim that a relational, nondualist framework is essential to an understanding of the active materality of nature. Simple acceptance of the materialist basis of action is not enough. As Law (1992) argues, materialism and social relations interact in other sociologies but what distinguishes ANT is its *relational materialism*. Failure to take this further step invites asymmetrical analyses in which the material world is socially constructed and both domains remain ontologically separate (Murdoch 1997a,b). The bridge across this divide then is one-way, since human praxis ultimately is the unique metric of the 'production of nature.' The analysis thus reverts to the terrain of instrumental transformative labour processes and the Promethean contours explored by Benton (1989).

Haraway (1992) raises similar issues in her critique of Young (1985) for adopting "a theory of mediations between man and nature," in which "nature could only be a matrix or product, while man had to be the sole agent" (p. 83). Rejecting the mediationist notions of Marxist humanisms, Haraway (1992) argues that "Refiguring conversations with those who are not 'us' must be part of the project. We have got to strike up a coherent conversation where humans are not the measure of all things, and where no one claims unmediated access to anyone else" (p. 84). Recent nature–culture hybrids and 'implosions' engineered in agricultural technoscience make these conversations ever more compelling and the conceptual language and ontology of ANT provides one way of joining in.

In the SSK and other literatures, however, the relational materality of ANT is seen, somewhat paradoxically, as a source of both strength and weakness. Thus its advocates applaud the transcendence of modernist dualisms as a major advance, whereas detractors of ANT argue that its unswerving adherence to the methodology of 'generalized symmetry' makes it ineffectual as social critique.[5] Shapiro (1997), for example, objects that ANT's insistence on ontological symmetry involves the loss of normative positioning. ANT stands indicted for its impartial detachment, of

opting out of "struggles over *how* to see" in Haraway's phrase, with related charges of totalizing pretensions (Lee and Brown 1994; Koch 1995). In this vein, McClellan (1996), echoing an earlier commentary by Collins and Yearly (1992), singles out Latour rather than ANT itself to criticize his use of the principle of symmetry to "flatten the world" as an analytic strategy to claim that "ANT stands at the height of epistemic privilege" (McClellan 1996, p. 194 and note 4, p. 206). Other contributors are also critical of such excesses but, recognizing the size of the task ANT has taken on, remain sympathetic to its more modest claims (Pels 1996; Murdoch 1997b).

The paradox arises, however, because some scholars, including several of these same critics, are drawn to ANT's insistence, as Pels (1996) puts it, on "the permeable boundary running between humans and nonhumans" (p. 297). That is, they discern an ethical situatedness, a relational moral philosophy, in ANT's emphasis on the construction of worlds through the interchange of properties, of materialities and socialities, between human and nonhuman entities. Thus, Whatmore (1997) suggests that "Latour's notion of hybridity as nature–culture collectives" (p. 47) exposes connectivities erased by dualistic modernist perspectives and can be used to construct a relational ethics. As Kovach (2000) puts it, "this *seeing* reshapes our ethical understanding" (p. 6, original emphasis). Other scholars argue that ethical choices and principles of conduct are the sub-text of ANT (Koch 1995) or, what amounts to much the same thing, that ANT should abandon the dubious search for methodological consistency and recognize the ethical dimensions of its commitment to 'generalized symmetry' in order to "move from methodology to ethics" (Shapiro 1997, p. 105). Similarly, Murdoch (1997b) follows Koch (1995) in concluding that "the true value" of ANT lies in the attempt "to enshrine a new set of ethical concerns in social scientific approaches to science and nature." These theorists "force us to look afresh at the categories, divisions, and boundaries that frequently divert our attention away from the nonhuman multitudes which make up our world. In this endeavor we might conclude that, strictly speaking, ANT does not qualify as a 'critical theory' but we should recognize that it performs a critical task . . ." (Murdoch 1997b, p. 753).

This finely-balanced assessment arguably is unfairly restrictive insofar as critical theory implicitly is defined in *humanist* terms: social injustice and inequality, with a correlate emphasis on the singularity of human cognition and human agency.[6] From a posthumanist perspective, however, as Pickering (1997) argues, "it is no longer clear that critique and reflection have to move along this axis. Posthumanism directs our attention to the multiple intertwinings of the human and nonhuman, and critique might, for example, direct itself towards specific human/nonhuman assemblages . . ." (p. 191).

This broader notion of critique also directs attention to the political project to incorporate nonhumans, disenfranchised by modernist antinomies, which Koch (1995), Shapiro (1997) and others discern in the ethical choices embedded in ANT methodology. This concern has parallels with the rich vein of critique found in the Marxian tradition of the Frankfurt School and in red/green thought, which focuses on the nexus of domination constituted by utilitarian views of nature and exploitative social relations. The critical work of "deconstruction of received ontology" to expose reification is vital if we are to restructure "our sense of the world" and redefine "our place in it" (FitzSimmons 1989a, pp. 108–109). Challenging radical geographies to discard the Enlightenment invention of primordial nature, FitzSimmons

urges that "*We must recognize that externalised, abstracted, Nature-made-primordial provides a source of authority to a whole language of domination*. This is the domination *of* nature, but also the domination of human reality *by* Nature" (ibid, p. 109, original emphasis).[7]

By undermining the modernist ideology of nature as external, ANT takes its place with other projects seeking to bring nature and its active, relational materiality back into critical social science. This attention to how 'socionatures' are constructed broadens critical engagement with capitalist political economy, and our understanding of the heterogeneous associations which thrive under this ordering of the socio-ecological. The dimensions of this political space are extended further if we follow Whatmore (1997) in reformulating ANT as an ethical discourse of how to live in the world. This recognition of ethical, not only material, embeddedness speaks directly to the central problematics of bio-political activism.

Furthermore, with its 'thick' descriptions of the assembly, coordination and durability of powerful networks, ANT provides conceptual tools to understand how these "translation regimes" (Callon 1991) might be dismantled – identifying the "anti-programme" (Latour 1992) – and power reconfigured. As Latour (1993) observes, the principle of symmetry also is intended to clarify "the practical means that allow some collectives to dominate others" (pp. 107–108). Description as explanation thus has its critical uses in disentangling the filaments which support the nodes of power, the 'centers of calculation,' in actor-networks. In this respect, ANT contributes to the work of critique, as in Haraway's interrogation of technoscience: how, for whom, and at what cost? (Haraway 1997).

To recapitulate and draw out the links between this theoretical discussion and politics, new socionatural assemblages are emerging under the aegis of modern technoscience to constitute new worlds. As Pickering (1997) suggests, we need conceptual frameworks and modes of reflexivity which explicitly focus normative judgement and political critique on these human/nonhuman assemblages and address Haraway's fundamental questions. Accordingly, we must learn to openly acknowledge and accept that we are collusive partners in these socionatural assemblages and develop forms of social organization which foster democratic choice between alternative orderings and their worlds. For this purpose, ontologies are needed that expose the human/nonhuman constitution of these orderings, not dualistic perspectives which abstract and conceal our interactive, relational transformation of worlds we inhabit with others. The novel socionatural assemblages of contemporary agricultural technoscience, and the risk of irreversible, unintended and shared socionatural harms, remind us how much ontological choice matters.

Conclusion

Reflecting their early disciplinary and institutional *raison d' être*, the social sciences are burdened with heavy ontological baggage whose original seals are still very much in place (Benton 1991, 1995). The 'greening' projects now underway in various theoretical literatures are testimony to this ontological 'blind spot' and the difficult task of eradicating deeply ingrained, dualistic modes of analysis. These projects, in other words, make our ontological choices explicit. This counsel of awareness is reinforced by recognition that political agendas are obscured by ontological

categories and their reification (FitzSimmons 1989a). Here, ecological reconstructive projects and perspectives such as ANT have a significant critical role to play by opening up these 'black boxes,' as Vogel (1996) has argued.

Benton (1989), Castree (1995) and others, both within and outside the Marxist tradition, also have emphasized that the analytic point of entry privileged by the inherited concept of the labour process leaves little or no space for the issues of green politics. This is not to dismiss the strengths of this perspective. Rather, it is simply to observe that this theoretical lens or 'framing' device does not focus directly, for example, on the new socionatural relations, inter-species metabolisms and exotic corporealities unleashed by agricultural biotechnologies. As we have stressed, these new constellations or assemblages of nature–society relations are key catalytic elements of contemporary bio-political activism in agro-food network.

The prospect of more flexible, assured engagement with these bio-politics has drawn contributors to other theoretical frameworks and conceptual resources, particularly as production continues to lose ground as the locus of critical praxis and social activism. The important point, however, is to bring different analytic positions into conversation in order to promote the theoretical renewal of agro-food studies and support social struggles against unfettered and undemocratic technoscience. Bio-political activists are successfully extending these arenas, giving added urgency to the project of renewal, which is no more than an early work in progress at this juncture.[8]

Notes

1. See, for example, Watts (1995), who remarks that "the underdevelopment of an ecological Marxism is not due to any intrinsic weakness of the analytic frame developed by Marx but rather to the particular trajectory of subsequent theoretical developments made in his name" (p. 185). When all the dust has settled, this also is the tenor of Burkett's critique of Benton and O'Connor (Burkett 1998a,b).
2. See, for example, the frequent exchanges on the theme of humanism and Prometheanism in the pages of *Radical Philosophy* in the early 1990s.
3. I am grateful to Margaret FitzSimmons for discussion of these points.
4. Against "the *Homo faber* myth," Latour (1994) argues that "The traditional definition of techniques as the imposition of a form consciously planned onto shapeless matter should be replaced by a view of technique . . . as the socialisation of nonhumans" (pp. 52–53).
5. This charge is constructed from a raft of objections to actor-network concepts, notably to agency and the role of intentionality, as well as critics' unwillingness to abandon social categories of explanation, such as interests, class, gender, and inequality, which are not part of ANT's ontology. As Murdoch (1997b) observes, the problem here is that normative distance is gained at the cost of symmetry, which risks reenacting the dualisms. For discussion of these issues, see Pickering (1993), Fuller (1994), Casper (1994) and McClellan (1996).
6. In defense of Murdoch (1997), he does emphasize Latour's "aversion to critical theory" and preference for description and interpretation. Other leading actor-network theorists, notably Law and Callon, are less deprecatory and more sanguine about ANT's contribution to critical social theory.
7. FitzSimmons (1989a) goes on to observe that "We are shown one side of this – the domination *of* nature by Marx. . . But Marx was not free of the ontology of his time; though he hints at the social production of nature, he often slips into a language which implies that nature is external" (p. 109).

8. Noel Castree's conclusion is apposite here: "We are presently strung out between theories like Marxism, which seek to materially *explain* nature's nature, taking those 'natural' entities as the things to be explained, and theories which, like cultural studies of science, seek to explore the *concept* of nature or what it is to call and manipulate entities as 'natural' in the first place, its historical emergence, its meanings, its deployment and its effects" (Castree 1995, pp. 40–41).

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