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Scientisation vs. Civic Expertise in Environmental Governance: Eco-feminist, Eco-modern and Post-modern Responses

KARIN BÄCKSTRAND

This article examines three critical perspectives in green political theory arguing that environmental governance is emerging as an increasingly scientised and technocratic domain. These are contrasted with work under the banner of 'civic expertise' proposing increased citizen deliberation and participation in the scientific realm to reverse the technocratic features of environmental management. Eco-feminism links the rise of technocratic science to an overall critique of modernity, rationality and patriarchy. Eco-modernism aims at re-configuring scientific rationality in terms of reflexive modernisation, and a stronger participatory dimension of civil society. In the postmodern green critique, the ascendancy of regulatory science marks the influence of biopower or green governmentality. Civic expertise is advanced as a middle ground between these contested appraisals of science in modern societies. This is underpinned by a post-positivist account of scientific knowledge and promotes a reform of the scientific endeavour toward enhanced transparency, participation and democratisation.

At a time when scientific knowledge is regarded crucial to identifying problems and devising solutions to global environmental problems, the role of science in modern societies is increasingly contested. Critics argue that the forces of modern science and technology have accelerated the environmental crisis, enhanced technocracy and diminished democracy. Hence, the relationship between science, risk and democracy raises critical questions of the proper place of scientific expertise in democratic decision-making concerning global environmental risks. This article revolves around the claim that environmental politics is increasingly scientised and technocratic. The scientisation of environmental politics implies that political and social issues are better resolved by technical expert systems than democratic deliberation. According to this argument, the technocratic features of regulatory science in environmental decision-making are embedded in a prevailing discourse of ecological modernisation stressing technical rather than social solutions to

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environmental threats. In this respect, environmental policy is a site that displays a contradiction between democratic theory and technocratic practice and a tension between expert systems and citizens. I start by presenting three green perspectives – ecofeminist, eco-modern and postmodernism – which all offer a trenchant critique of how science and technology generate unprecedented environmental risks. However, I demonstrate that research under the banner of ‘civic expertise’ (including notions of citizen science, stakeholder and democratic science) provide a coherent agenda for reforming the scientific endeavour toward incorporating transparency, accountability and participation. A central argument is that the recent deliberative turn to science, represented by the work on civic expertise, holds the largest promise to re-configure science toward participatory modes of inquiry.

In the first section, I outline the argument that environmental governance is increasingly scientised, and that this, in turn, is symptomatic of an entrenched discourse of ecological modernisation in contemporary societies. The second, third and fourth sections explore how the ecofeminism, ecomodernism and the postmodern green critique respond to the rise of regulatory science in environmental management. These critical perspectives argue, from different vantage points, that environmental politics is a site for technocracy and link environmental destruction, science and modernity in different ways. A divisive question is whether environmental problems can be resolved within the institutions of modernity, i.e. by relying on more science and scientific rationality. In the fifth section, the normative, epistemological and institutional underpinnings of the notion of civic expertise are examined. Civic expertise renews the focus on the relationship between expert and citizen as well as participatory mechanisms to democratise science. Moreover, it holds the promise to steer between the wholesale rejection of scientific rationality and the uncritical acceptance that science can provide ultimate solutions to the environmental crisis.

Ecological Modernisation and the Scientisation of Environmental Politics

There is a recurrent argument that environmental policy-making is becoming more science-driven and expert-oriented. Environmental problems are couched in technical narratives leading to a simultaneous scientisation and de-politicisation of environmental governance. In this perspective, citizen participation in a modern expert society, which is dominated by complex technological risks, is at stake [*Fischer, 2000*]. The scientisation of environmental governance is embedded in a discourse of ecological modernisation that affirms the mutual reconciliation of environmental and development objectives and assigns the state, market and science a pivotal role in transforming institutions toward ecological progress.¹ Ecological

modernisation as a discourse expresses a 'win-win' situation, in which environmental goals are conceived as compatible with economic development or growth. In the language of ecological modernisation, environmental protection and economic development are seen as compatible and mutually reinforcing goals. Hence, ecological modernisation 'indicates the possibility of overcoming the environmental crisis without leaving the path of modernization' [*Hannigan, 1995: 183*].

The technocratic practices defining environmental policy-making are squarely placed in a discourse of ecological modernisation in which scientific and technical expertise are regarded as the key to environmental progress [*Mol, 2001: 61*]. In this discourse, science is crucial and authoritative instrument in providing a neutral and factual input for crafting rational policies. Regulatory science becomes a domain of its own, armed with problem-solving methods exemplified by techniques such as cost-benefit analysis, evaluating environmental impact and risk assessment. The ascendancy of planetary 'mega-science' and 'Earth system science' in environmental diplomacy can be seen as congruent with the dominant discourse on ecological modernisation. The evolving practice of 'sustainability science' [*Kates, 2002; Raven, 2002*], which encompasses a global multi-disciplinary approach to uncover resilience levels in nature-society interaction, epitomises the central role of prediction and control given to science in ecological modernisation.

The radical ecological movement warns that this techno-scientific version of ecological modernisation betrays strong environmentalism by paving the way for technocracy and consolidating consensus between scientific elites, corporations and governments. In this 'weak' and top-down version, ecological modernisation can be conceived as state-sponsored and corporativistic and technocratic environmental problem solving. In contrast, in a 'strong', green and less state-centric version, ecological modernisation implies 'ecological democracy' or 'ecological enlightenment', in which public deliberation, communication and participation by civil society are vital components [*Christoff, 1996: 490–91; Dryzek, 2000; Barry, 1999: 113ff*]. The critics of technocratic version of ecological modernisation envision a more inclusive, democratic and participatory citizen science which represents an alternative to centralised top-down 'mega-science' run by scientific elites [*Irwin, 1995; Fischer, 2000; Kleinmann, 2000*].

How do eco-feminism, eco-modernism and post-modernism evaluate the rise of technocratic science in the governance of environmental risks? And is reforming science along lines of civic expertise realistic, i.e. what are the prospects for increasing citizen participation in scientific decision-making? The next section outlines the eco-feminist position that represents the radical

green critique by elucidating the links between science, modernity and the exploitation of nature and women.

The Eco-feminist Critique of Science

Eco-feminism and the feminist critique of science converge in their critical assessment of the pivotal role of science in modern societies. Eco-feminism can be conceived as an umbrella term for research and activism that have linked feminism with environmentalism by drawing attention to the interconnections among masculine biases in science and technology, the destruction of the environment and the subordination of women. The analytical category of gender is employed to demonstrate the prevalence of androcentrism in science [Zimmerman, 1994: 127ff; Mellor, 1997: 276ff]. Eco-feminism remains deeply sceptical of the key assumption in ecological modernisation, namely that science can contribute to solving environmental problems through technological innovation. In contrast, the dominant forms of scientific knowledge and practice, which are embedded in the hegemony of instrumental rationality and reductionism, are conceived as the roots of the contemporary environmental crisis [Mies and Shiva, 1991].

The feminist critique of science [Keller, 1992: 1997], which has shed light on the masculine ideals that permeate the scientific project or 'mindset', overlaps with the eco-feminist scepticism about science's promise to deliver progress. The problems of environmental destruction and gender subordination are linked to the instrumental rationality found in science and its applications. Hence, the nature of the environmental crisis is largely attributed to Enlightenment ideals and the pace of scientific and technological progress. The relationship between human societies and the environment is gendered, i.e. structured by patriarchal relations that have positioned women closer to nature. However, feminist philosophy of science has stretched the argument further: the central norms underpinning science – rationality, objectivity and control – are also celebrated masculine ideals.

Eco-feminism vs. Postmodern Feminist Environmentalism

Eco-feminism can be seen as part of a broader radical ecology movement [Merchant, 1992; Zimmerman, 1994] echoing concerns of the critical theory that postulates a link between instrumental rationality and the exploitation of the environment. It also draws on a radical feminist critique of patriarchy that argues that the hierarchical ordering of reality associates the male/masculine with mind/culture and the female/feminine with body/nature. Moreover, the disproportionate under-representation of women in the scientific endeavour signifies the gender hierarchies that are manifest in scientific knowledge production in modern societies. An important assumption in eco-feminism is

the conceptual connection between the subordination of women, the destruction of the environment and scientific rationality. This revolves around the women-nature association – women are associated with nature and the feminine, which, in turn, are devalued and degraded.²

However, the central eco-feminist proposition, i.e. the twin oppression of women and nature [Warren, 1994: 2], is contested within feminism. The fiercest criticism is articulated by postmodern feminism, which has deconstructed the universal concept of ‘woman’ and investigated how it is mediated by class, ethnic, racial and sexual identity. Postmodern feminist inquiry challenges the eco-feminist claim that the environmental crisis can be attributed to a masculine scientific mindset [Haraway, 1989; Sachs, 1997; Cuomo, 1998]. The main criticism is that the symbolic association between the oppression of women and the destruction of nature is overly simplistic [Bretherton, 1996]. Postmodern feminism questions the universalistic and essentialist assumptions of concepts such as ‘woman’, ‘nature’ and ‘science’, which are seen as discursive formations. In this analysis, the linkages between environmental degradation, the subordination of women and the rise of western science are less straightforward. The assumption that human relationships with the environment are gendered is retained, but the idea that women are closer to nature (biologically or socially) is abandoned. The task of research is rather to explore the different material relationships that women and men have with the environment in different cultural contexts and to recognise that gender relations are mediated by class, ethnic, racial and national identities [Jackson, 1994; Sachs, 1997].

Linking the Environmental Crisis and Androcentric Science

Beyond these contested positions, what remains is a fundamental critique of the increasing ‘rationalisation’ of the environment, in which science and technology play central roles. Merchant [1980] analyses the scientific revolution of the sixteenth and seventeenth centuries arguing that the arrival of modernity meant that an organic view of nature as female/active was replaced by a mechanistic view of it as matter, which led to the ‘death of nature’. The control over nature through science was a central theme in Francis Bacon’s writings, which were tainted with sexual metaphors [Lloyd, 1984]. The acquisition of scientific knowledge in this respect became inextricably linked with the domination and control of nature and women in the new science [Fox Keller, 1992; 1997].

The dualistic ordering in patriarchal societies characterises the production of scientific knowledge. Science is associated with rationality, objectivity, control and distance – traits that in western societies are associated with masculinity. Both the feminist critique of science and eco-feminism has illustrated how the scientific knowledge as disembodied knowledge

displaces alternative ways of knowing. Using Indian women's lives as a starting point, Shiva [1989] argues that the ecological destruction and the marginalisation of women are the results of the hegemony of western science and western economic development paradigms [Shiva, 1989: 14–15]. The denial of the 'feminine principle' that upholds diversity in agriculture has led to a monoculture and a loss of biodiversity. The ongoing appropriation of the genetic diversity in the South by the western biotechnology industry is symptomatic of the reductionist mindset of modern science [Shiva, 1997].

To conclude, the contributions of eco-feminism reside in an overarching critique of the hegemony of western rationality, science and technology. However, an analysis of the role of environmental science in contemporary environmental management is largely absent. The new role of science in the discourse on ecological modernisation is not seen as vehicle of transformation according to eco-feminism. The radical versions of eco-feminism hold that science cannot solve environmental problems. On the contrary, the scientific mindset has generated environmental problems in the first place because science is a dominant narrative that has instrumentalised nature. In the next section, a more positive account of regulatory science is traced in eco-modernism.

Eco-modernism: Regulatory Science as Reflexive Scientisation

The eco-modernist assessment of the ascendancy of science in ecological modernisation represents a more benevolent scenario. In contrast to the highly critical stance toward science and modernity taken by eco-feminists, eco-modernism presents a more optimistic account of the prospects for science to mitigate global environmental risks. Rather than abandoning modernity and rational scientific inquiry, a new reflexive modernity is envisioned, which draws upon theories of risk society and reflexive modernisation. Beck's [1992; 1994] theory of a risk society can be seen as a middle way between modernism and postmodernism. Scientific rationality should be replaced by a social and ecological rationality that entails a self-critique of the progress of 'scientific truths'. Science should be demopolised and democratised and redirected toward a social rationality.

The Transition from Industrial to Risk Society

What is the new role of science in the theory of risk society and reflexive modernisation? Beck's original argument is that the older industrial society is now being replaced by a risk society. Pre-industrial societies were defined by unpredictable catastrophes such as plague, famine, war and natural disasters. In contrast, industrial societies were marked by calculable risks that could be

dealt with through rational-instrumental control by means of insurance, bureaucratic and scientific expert systems. While industrial societies were marked by a distribution of goods, risk society is characterised by the distribution of 'bads' or 'hazards' that are blind to traditional class divisions. Global environmental 'mega-hazards', e.g. nuclear, ecological, chemical and genetic risks, are not limited in time and space, do not conform to the established rules of causality and cannot be compensated for by the existing safety and insurance systems. Hence, these risks propel the institutional crisis of industrial society itself. These hazards, i.e. the unintended negative side effects produced by modern industrial society, cannot be contained in the modernist system of prediction and control. The so-called safety systems of the provident state are unable to handle, and cannot account for, incalculable global environmental risks. The hazards themselves produce a window of opportunity for redefining the rules and principles of decision-making. Hence, the new and more superior form of modernity is conditioned by the emergence of global environmental threats.

In order to counteract the damages and global risks resulting from the simple modernity in industrial society there has to be 'modernisation of modernity'. This has paved the way for Beck's [1994; 1997] more recent work on reflexive modernisation. Society has to initiate a self-confrontation and institutionalise self-reflexion. Reflexive modernisation entails a self-transformation of industrial societies that will stimulate a reinvention of politics [Beck, 1997:17]. Consequently, the practices of environmental policy-making have to be fundamentally rethought and changed, since the ecological risks are incongruent with the institutions of simple modernity. What, then, are the implications for the organisation of scientific expertise in environmental decision-making?

De-monopolisation and Democratisation of Science

The discourses and practices of science are at the heart of theories of risk society and reflexive modernisation. The encroachment of scientific and technological practice can be seen as a cause of environmental problems. However, if the role of science in decision-making can be reframed, science can also present the solutions to global environmental hazards. A distinction is made between primary and reflexive scientisation [Beck, 1992: 158ff]. Primary scientisation belongs to the epoch of the industrial society and simple modernity associated with a positivistic science with a claim to universal and objective truth. Moreover, there is a clear division between the enlightened priesthood of scientific experts and ignorant laymen. Science has become increasingly professionalised and inaccessible to non-experts.

In contrast, reflexive scientisation implies that scientific decision-making on environmental risks is opened up for social rationality and wider

participation [*Hannigan, 1995: 182*]. Society has to exercise a new level of self-critique and systematic self-doubt has to be invoked in science [*Beck, 1996: 33–34*]. Authoritative decisions cannot be made by a narrow group of experts but have to include a wider spectrum of stakeholders. This entails a de-monopolisation of scientific knowledge and a democratisation of science [*Beck, 1992: 163*]. Stakeholders such as NGOs, the business sector and the general public become active co-producers in the social process of constructing knowledge. A self-critical ecological democracy is part and parcels of reflexive modernity [*Beck, 1995*]. The new social movements and public opinion signify the vanguard of the new reflexive mode of knowledge and modernity. Ecological movements, lay people and citizens in this vein represent a counter-expertise.

Reflexive modernisation does not imply the wholesale rejection of scientific practices. However, the expert-centred forms of knowledge with their secrecy and centralised character need a democratic check [*Barry, 1999: 202*]. The use of science in environmental management must be rooted in a democratic, free and open society that incorporates self-interrogation and institutionalised self-criticism.

Postmodernism: Regulatory Science as Green Governmentality

How is the rise of regulatory science in environmental governance conceived in the postmodern cultural critique? The postmodern perspective shares with eco-feminists and eco-modernists a concern with respect to the rise of technocracy in environmental decision-making. However, this tradition regards it as highly problematic that the normative and cultural assumptions underlying environmental discourse are not recognised in green political theory at large. Unless there is recognition of the power practices and cultural biases found in the construction of ‘environmental threats’, there will be no reflexive and critical turn in environmental politics. Hence, the purpose is to install a critical element with regard to the social forces and consequences of the historical and contemporary construction of environmental risks.

A Constructivist Ontology of the Environment

The postmodern cultural critique builds on a constructivist and anti-foundationalist conception of scientific knowledge, questioning the ontology of environmental risks. In this perspective, the problem with the discourse on ecological modernisation is that its cultural bias and normative underpinnings are concealed. Both eco-feminism and eco-modernism rely on overly objectivist, naturalist and realist understandings of what the problems ‘really are’. The theories of risk society and reflexive modernisation rest on a realist account of the growth of global environmental risks and technological

hazards. Beck's conception of a new generation of environmental mega-hazards as *objective* global risks, affecting everybody equally in a 'democratic' fashion has been criticised on several accounts [Wynne, 1996; Lidskog et al., 1997: 125].

The postmodern perspective underlines the cultural bias of scientific knowledge at work in environmental management. It warns against grounding environmental politics in a universal and coherent scientific 'truth' about environmental problems. According to feminist historian of science Donna Haraway [1988], knowledge about environmental processes is 'situated', i.e. tied to a specific place and cultural context despite its universal aspirations. A discourse on ecological limits may reinforce existing relations of power, paving the way for instruments of control, prediction and management. The relevant question to be asked is: 'What are the main dangers we are facing – including the normalising dangers of environmental discourses themselves?' [Darier, 1999c: 27].

Scientisation as Biopower

Postmodern positions problematise the belief that nature or the environment can be managed and governed by the application of the scientific principles. Environmental problems similar to 'madness', 'sexuality' and 'criminality' are not 'out there' in a pure and unmediated form, but various techniques, procedures and practices construct and produce these fields in such a way that they become both objects for knowledge and targets for regulation. The construction of 'environmental problems' as an object of regulation around which a truth is produced is an example of this [Darier, 1999a]. How can scientific discourses on the environment, facilitated by scientific practices, make the environment a manageable target and an object for regulation? When environmental problems are the targets of knowledge and regulation, the environmental science community is authorised to frame the parameters for decision-making, to reproduce and even 'naturalize' a version of optimal management of environmental problems. In regulatory science, the environment is constituted as an object of knowledge that needs to be managed in order to protect the population from hazardous risks.

The biopolitics of the population [Foucault, 1976: 139] refers to the administration, measurement and management of human populations by means of carefully collected statistics on criminality, physical and mental health and immigration numbers. In Foucault's work, a shift from the microphysics of power (disciplinary technologies of the body) to macropower – governmentality and biopower (regulation and management of populations) – can be traced. The latter focuses on the administration of life itself; everyone and everything should be managed – individuals, populations and the natural environment. This represents a more global form of power tied to

the modern state and its institutions that revolve around big science, big business and big government.

The notions of biopolitics and biopower have been extended to the use of environmental science and technology. There is a link between regulatory science (such as environmental science) and modern biopolitics, which, in combination, have paved the way for the growth of big science, in which the state and industry have stakes. The advent of modern biology meant that life processes could be controlled and modified, which is epitomised by genetic engineering. The management of living things and their relations to security and welfare became the platform of political power. Discourses on environmental management turn the environment into a manageable object. The various policy tools associated with regulatory science – scenario analysis, integrated assessment modelling and cost-benefit analysis – can be conceived as techniques of ‘econormalisation’ [Rutherford, 1999: 38ff]. These are the techniques of biopower, extending governmental rationality to the management of living things and the environment.

The genealogical critique can be conceived as an emancipatory ‘anti-science’. However, genealogy is not opposed to science and reason but rather undermines the blindness of mainstream social science to the asymmetries in the scientific acquisition and application of knowledge [Foucault, 1980: 83–5; Hoy Couzens, 1998: 21]. Transferring this to environmental politics, ‘[e]nvironmental resistance... includes the questioning of the dominant discourses and practices around “nature”’ [Darier, 1999b: 224]. In sum, postmodern environmentalism remains sceptical of the emancipatory and normative vision found in reflexive modernisation and ecological democracy.

Civic Expertise: The Epistemological, Institutional and Normative Agenda

The emerging work under the banner of ‘civic expertise’ represents a middle ground between the eco-modernist call for reflexive science, the eco-feminist rejection of instrumental scientific reason and the postmodern scepticism of scientific progress. This perspective is reflected in disparate work on deliberative democracy [Dryzek, 2000; Pellizzoni, 2001; 2003], science studies [Jasanoff and Wynne, 1998; Jasanoff, 2003a; 2004], sociology of science [Fuller, 2000] and policy studies [Fischer, 2000]. All these works envision a transformation of dominant practices of science to be more transparent, responsive and accountable to citizens. The renewed interest in citizen science [Irwin, 1995], indigenous knowledge [Leach and Scoones, 2003], local and lay knowledge [Jasanoff and Martello, 2004] signal the participatory turn to scientific expertise. The critical green perspectives and

work on civic expertise have all in common the critique of the ascendancy of technocratic expert systems in environmental politics. Hence, the scientisation of environmental governance is regarded as deeply problematic. Moreover, the importance of enacting a more participatory bottom-up vision of science is underlined by both the green political critique and proponents of civic expertise. However, they differentiate in how scientific knowledge is conceptualised, in how the structural changes in modes of knowledge production are assessed and in the prospects for democratising science.

I argue that the notion of civic expertise contains a more realistic and sophisticated account of the scientific enterprise as well as a positive vision for the new governance of science, in which stakeholder participation is a core concern. A more coherent agenda for democratising scientific expertise can be found in this work. The democratic restructuring of scientific decision-making requires not only institutional reform but also a critical examination of scientific knowledge itself. Three dimensions are critical in rethinking science, namely the epistemological, institutional and normative. The epistemological dimension revolves around the nature of scientific knowledge and what counts as expertise. The normative relates to the goal to democratise scientific expertise by enhancing representation, transparency, participation and accountability in the scientific realm. The institutional refers to inventing deliberative mechanisms for public participation in the new context and governance of science. In the following, I will outline the tenets of civic expertise along these three dimensions, and how, in turn, it can be distinguished from ecofeminist, eco-modernist and postmodern appraisals of science.

The Epistemological Turn to Uncertain and Pluralistic Knowledge

The disparate work on civic expertise shares the critical examination of, and engagement with, scientific knowledge and practice. Underpinned by a post-positivist account of science, it adopts insights from a multiplicity of perspectives such as discourse analysis, science studies and constructivism. The contingency of scientific claims, the negotiated character of scientific knowledge and the cultural and political context of scientific practices are recognised. Paradoxically, at a time when the need for consensual scientific knowledge is underlined, science is also more contested and pluralistic. Scientific decision-making is inextricably intertwined with values, conflict, bias, trade-off and interest, prompting us to rethink our understanding of scientific knowledge itself. Despite the aspiration to the objective and neutral ideal of science, scientific expertise is oftentimes pluralistic, divided, uncertain, contested and normative. In this perspective uncertainty and ignorance should be openly recognised and the limitations of science with respect to deliver certainty and truth should be admitted. Jasanoff [2003b]

advocates a culture of 'technologies of humility' to complement the traditional 'predictive' in methods in science such as risk assessment. Thereby the limits of scientific knowledge are acknowledged, such as the inherent conditions of the unknown, the uncontrollable, and the uncertain.

The point of departure is that expert knowledge is both uncertain and pluralistic. First, conditions of radical *uncertainty* define the scientific endeavour, exemplified by genetic engineering, climate change, chemicals proliferation and mapping of the human genome. Science has in many issue areas taken on a post-normal character: facts are uncertain, values are in dispute, stakes are high and decisions are urgent [Ravetz, 1999]. Techno-hazards cannot be adequately resolved by the traditional routines of 'normal' science, such as established methods of risk assessment and cost-benefit analysis. In the face of radical uncertainty and ignorance, the governance of risks should rest on collaboration between, and participation by scientists, citizens and civil society. Proposals for 'extended peer communities' follow this rationale arguing that affected stakeholders provide alternative knowledge in scientific decision-making [Ravetz, 1999] Hence, radical uncertainty prompts the need for a deliberative process.

Secondly, this is related to the increasingly *pluralistic* character of expert knowledge. There is a shift in emphasis from a unitary notion of science to an emphasis on different knowledge(s), including but not limited to modern science. Hence, it is increasingly problematic to equate expert knowledge with scientific knowledge only. This implies questioning the borders between science and non-science, expert and lay knowledge, universal and local knowledge. The question of who is the legitimate expert is critical in this context. In this perspective, all expert knowledge is situated in a specific local, political and cultural context, inherently value-laden and imbued with worldviews. This perspective does not deny the significance and importance of science and professional expertise nor the physical reality of environmental problems. However, it aims to better understand the interaction between technical fact and cultural values, science and non-science and the powers at work when defining those boundaries.

Civic expertise overlaps with the postmodern scepticism toward an objectivist account of science. Both embrace a post-positivist conception of scientific knowledge as constituted through social and political processes. Moreover, both perspectives recognise the 'situatedness' of environmental knowledge, i.e. that all knowledge, whether 'universal' or 'local' is attached to a specific place and produced in a cultural context [Haraway, 1988]. The eco-feminist rather deterministic interpretation of scientific knowledge as harbouring a masculine mind-set of instrumental reason is also at odds with constructivist account of science. Recent work on the co-production of the scientific and social order recognises how scientific practices are ingrained in

cultural narratives and vice versa [Jasanoff, 2004]. Knowledge in this vein can simply not mirror of power relations (such as gender) in society, instead scientific knowledge ‘both embeds and is imbedded in social practices, identities, norms, conventions, discourses, instruments and institutions – in short, in all the building blocks of what we term the *social*’ [Jasanoff, 2004: 3]. It is also a remedy for the shortcomings of eco-modernism that does not question the basic institutions, structures and practices of science [Fischer, 2000: 59]. A conventional model of science is retained in eco-modernism: there is little re-thinking of what scientific knowledge means and what counts as expertise. Finally, it is underpinned by an objectivist notion of scientific expertise and realist conception of environmental risks [Wynne, 1996]. There is a separation between scientists and the citizen activists of counter-science [Ravetz, 2003]. The dichotomous divide between nature and society, social and scientific knowledge, expert and non-expert knowledge and science and the public domain is still retained in eco-modernism. Hence, the eco-modernist vision for reflexive scientisation does not rely on a new conception of science.

The Normative Vision: Deliberative and Accountable Science

Research on civic expertise frames ‘democratisation of science’ in terms of deliberative and participatory democracy and accountability. Deliberative democracy has been advanced as a model of governance suitable to deal with the new and unprecedented techno-hazards and ‘intractable controversies’ [Jasanoff, 2000; Kitcher, 2001; Pellizzoni, 2001]. Issues such as bio-safety, genetic engineering, human cloning and the greenhouse effect are defined by lack of consensus on facts, values and policy principles. Moreover, citizens affected by these problems in their everyday should have a say. Hence, the epistemological uncertainty and large-scale stakes posed by these novel risks require an enlargement of the sphere of public discussion along the lines of deliberative and discursive democracy [Dryzek, 2000]. Following the paradigm of post-normal science outlined above, ‘extended facts’ – a plethora of different forms of expert knowledge (local, scientific, traditional, lay, etc.) – are required in order to improve quality of and legitimacy of scientific decision-making. Deliberative democracy suggests that in order for decision-making to be legitimate, affected parties should be included to voice their interests and arguments in a free deliberation with the potential to transform preferences [Bohman, 1996; Elster, 1996]. Applied to the scientific realm, citizens, experts, politicians and stakeholders should be included in deliberations on risk assessment and governance.

This resonates with arguments that the legitimacy of science is increasingly tied to accountability defined in terms of democratic politics rather than exclusive scientific accountability and quality assurance in terms

of peer review [*Jasanoff, 2003b: 233*]. Expertise can be conceived as a form of delegated authority, where experts are granted the power to speak for the public on issues demanding specialized knowledge. However, the legitimacy of expertise depends on if it conforms to principles of accountability, transparency and open deliberation. 'Expertise has legitimacy only when it is exercised in way that make clear its contingent, negotiated character and leave the door open to critical discussion' [*Jasanoff, 2003a: 160*]. This suggests that notions from democratic theory are imported to the scientific and technological realm. The calls for 'democratising expertise' and 'expertising democracy' reflect the rapprochement of knowledge producing and the democratic sphere [*Liberatore and Funtowicz, 2003*]. Concepts and practices such as citizen science and participatory technology assessment indicate the bridging of the expert and the citizen.

Influential writings in eco-feminist propose that subjugated, indigenous, grass-root knowledge should replace dominant forms of reductionist science (corporate, scientific, western) paving the way to participatory and democratic forms of inquiry [*Shiva, 1997*]. However, the dichotomous view of science vs. citizen dominates and the prospect for merging these spheres is deemed as unrealistic or even undesirable. Also, postmodernism's pessimistic view of science as an arena of endless power struggle in the end rules out citizen's democratic participation in science. Eco-modernism subscribes to the project to democratise science through greater institutional reflexivity, civil society participation and a sub-politics of counter-expertise. However, the democratisation of science is advocated by keeping the different universes of citizens and experts intact and by relying on the objective existence, rather than contested nature, of the new global environmental risks. Hence, the critical green perspectives fall short of concrete proposals for institutional mechanisms to incorporate public, citizen and stakeholder participation, which is the topic of the next section.

Institutional Innovations for Citizen Participation in Science

Perspectives advocating civic expertise argue that institutional mechanisms to enhance citizen participation in science are cornerstones in reversing scientised practices of environmental decision-making. Science is recognised as a major social institution: hence, there is need for procedures and innovations to incorporate a counter-expertise [*Ravetz, 1999: 648*]. Moreover, structural changes in scientific knowledge production require a new understanding of the role science in society. The call for a new contract between science and society is prompted by a secularisation of science, which entails a de-coupling of science from the state [*Fuller, 2000, Jasanoff, 2003b*]. In the new production of science, knowledge is diffused to actors and

institutions outside the universities, such as industry, government agencies and non-profit actors [Nowotny, 2003].

The diversification of knowledge requires a new governance of science. Stakeholder science, citizen science, indigenous knowledge movements are terms that signify how expertise is increasingly pluralistic, hybrid and diverse. The new governance of science means a 'trilemma' of ensuring scientific accuracy, policy effectiveness and political legitimacy in decision making in issues such as chemical hazards, biotechnology, cloning etc. [Pellizzoni, 2003]. There is a shift from reliable knowledge (that is validated in a disciplinary context) to robust knowledge that is socially distributed expertise [Nowotny, 2003]. As a result, there is a proliferation and revival of participatory procedures applied to scientific inquiry, such as citizen juries, citizen polls, participatory technology assessment, stakeholder forum, referenda and consensus conferences [Smith 2003]. In line with this, the recent white paper on governance in the European Union by the European Commission proposes a democratisation of scientific expertise through public participation in technological decision-making [European Commission, 2001]. However, the experiments of citizen participation do not necessarily amount to a democratic governance of science. In some instances, the turn to public participation represent cosmetic adjustment that do not challenge trenchant policy techniques. Dominant framing and structures of policy procedures, such as risk assessment and cost-benefit analysis may exclude attempts to re-conceptualize the expert-citizen relationship in a more deliberative fashion.

Conclusion

In this article, the purported scientisation of environmental governance has been examined from three critical green perspectives and the evolving work civic expertise. The eco-feminist, eco-modernist and postmodern perspectives highlight the inevitably instrumental, technocratic, gendered dimensions of regulatory science in environmental governance. In contrast, the multi-faceted scholarship on civic expertise argues that participatory and deliberative modes of scientific inquiry have the prospect to counter current trends of technocratic environmental decision-making.

First, eco-feminism links the rise of regulatory science in the discourse on ecological modernisation to an overall critique of modernity, rationality, patriarchy and other narratives in western civilisation. Both the environmental crisis and the oppression of women are attributed to the mindset of instrumental rationality that permeates science. Gender is employed as an analytical tool in theorising the conceptual and ideological linkages between contemporary environmental destruction, marginalisation of women and the

instrumental rationality permeating the scientific endeavour. In contrast, eco-modernism aims at re-configuring science and modernity towards strengthening the participatory dimension, inviting of stakeholders and citizenry in risk governance. Modernity and rationality are not abandoned but redefined in terms of reflexive modernisation. Hence, the attempt is to redefine and modernise scientific rationality, by making it more sophisticated, reflexive and self-critical. Sub-politics and the critical 'counter-experts' of ordinary citizens and grass-root movements will enhance the reflexive dimension of science, which will ultimately propel the democratisation of scientific expertise. Third, in the postmodern green critique, the prevalent discourse on ecological modernisation coupled with the expanded role of regulatory science mark the influence of biopower or green governmentality. Disciplinary power will also define the new scientific practices with wider stakeholder and citizen participation. While the two former perspectives are firmly rooted in modernity, the postmodernist green perspective abandons epistemological foundationalism in its critique of technocratic tendencies in environmental management. The dangers of technocratic environmental governance are highlighted but without resorting to a realist/naturalist/objectivist perspective.

In this article, the notion of civic expertise has been advanced as a constructive middle ground between the ecofeminist, eco-modernist and the postmodern critique of science. Its constructivist interpretation of scientific knowledge promotes a re-orienting of science towards greater institutional accountability, openness and responsiveness to citizens. In order to reverse the scientisation of politics, the social and cultural embeddedness of scientific knowledge of the environmental risks need to be highlighted. The rationale for a transparent, accountable, representative and even democratic science stem from the uncertainty, complexity and contingency of post-normal risks

The question whether environmental problems can be resolved within or beyond modernity remains contested in the various perspectives. Eco-feminism singles out the 'mindset' of modernity and reductionist science as the overarching cause of the environmental destruction. The eco-modern theories of risk society and reflexive modernisation propose a redefinition of modernity, rather than the abandonment of it. The scientific enterprise needs to institutionalise a self-critique. The postmodern account straddles between these positions. The dangers inherent in modernity are identified, but at the same time the anti-modern critique is abandoned as it is viewed as romantic and nostalgic. Power will always be practiced in all regimes of truth, particularly in the production and application of science, including when the scientific procedures are open to public deliberation. Civic expertise balances the thin line between scientific objectivity and scientific relativism, between the embracement and rejection of modernity. But its rational and pragmatic

tenets are epitomised by the call for open public deliberation, participation and inclusion of different knowledges in issues in the scientific realm with ramifications for citizens' everyday. The technocratic modes of governance are viewed as problematic in an age of unprecedented technological risks when what counts as evidence and what kind of knowledge deemed relevant are highly contested. The conflictual and adversarial nature of the politics of environmental risk demonstrates the need to enact a more deliberative policy process committed to value pluralism and thereby complementing dominant positivist approaches to the governance of science. Appraisals of technological risk should be conducted in a pluralistic and deliberative fashion applying discursive and participatory techniques.

Eco-feminism questions the objectivist and neutral aspirations of science and illustrates how scientific reason is embedded in gendered and patriarchal discourses. However, it does not capture the contemporary hybrid nature of expertise as boundaries between scientific, traditional, indigenous and lay knowledge are dissolving. Eco-modernism purports to democratise scientific expertise but retains a traditional perspective on scientific knowledge and practice. The wedge between the scientific expert and the citizen counter-expert, by scientific elites and grass-root knowledge is maintained. The postmodernist green critique rethinks scientific knowledge epistemologically but does not offer a positive theory on how to counter dominant trends of technocracy, except than resisting normalising discourses. In sum, the green critical perspectives fall short from appropriating the new forms of engagement between science and citizens and the changing notion of expert knowledge. In contrast research under the umbrella of civic expertise grapples with the epistemological, normative and institutional challenges to reverse the scientisation of environmental governance: what counts and qualifies as knowledge, new forms of institutional engagements between the public, citizens and scientific experts as well as institutionalising mechanisms for democratic deliberation in the scientific endeavour.

NOTES

1. There are many interpretations of 'ecological modernisation' from proponents of ecological modernisation theory to discursive accounts of the term, such as Hajer [1995]. Hence, ecological modernisation can be seen as a technical adjustment, a belief system, a theory of policy change, a prescriptive account of how policy should be made, or a discourse [Christoff, 1996]. For the purpose of this article, I regard ecological modernisation as a discursive framework in which environmental and sustainability issues are managed.
2. In the ecofeminist literature there has been a debate on whether the women-nature association has a biological base or whether it is a socially constructed relation. Cultural ecofeminists affirm, uphold and celebrate femininity as a superior mode of being. In contrast, social(ist) ecofeminism argues that patriarchal relations have historically positioned women closer to nature.

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