1. Shifting perspectives in environmental social science

**Frans Berkhout, Melissa Leach and
Ian Scoones**

INTRODUCTION

Any contemporary discussion of science, technology, governance and processes of modernization must take account of the ways in which conceptions of the environment are shaping them. Whereas, for much of the modern period, the environment has been considered distinct and separate: an object of inquiry and control, we are now becoming more aware of how ideas about the environment – and of environmental change – reflect deeper social and political preoccupations, while also influencing change in social institutions and social attitudes. We see increasingly that our knowledge of the environment is socially framed and embedded, including knowledge achieved through scientific methods. But we are also aware that responses to environmental change and people's perceptions of it are becoming more deep-seated and significant. The environment can no longer be disentangled so easily from social reality.

Nowhere has this complex, mutual link between environmental and technological and social change been more starkly illustrated than in the controversy over genetically modified (GM) crops and food. From the outset it seemed that GM crops were consistent with the demand for more environmentally-friendly forms of agriculture. Early innovators of GM crops made explicit use of environmental rhetorics in promoting the technology – arguing, for instance, that lower usage of pesticides and fertilisers lead to lower pollution and resource savings – while the introduction of new crop varieties was controlled by regulatory frameworks that included bio-safety and other environmental considerations. The international controversy and conflict that has emerged around GM, much of it based on concerns about environmental and social impacts, revealed a new set of problems about environmental knowledge and the management of environmental resources and risks (GECP, 1999). The GM controversy in Europe and elsewhere reflected a broadly-based understanding of the uncertainties surrounding

assessments of impacts and risks, as well as public scepticism about government responses. Publics were unwilling to accept uncritically government claims that 'sound science' suggested GM foods are safe; they were critical of the biases and commercial interests which support such expert claims; and they questioned wider issues – such as the future of agriculture – implied by the turn to GM crops (Grove-White et al., 2000). In developing countries, the spectacle of farmers burning fields demonstrated vividly concerns about the ecological effects of GM crops and about the perceived creeping domination of agriculture by large western companies, symbolizing a new privatization of environmental resources. These emergent public attitudes to GM crops – and an increasing array of environmental issues – have had, in turn, ramifications for the governance of environmental change, creating the conditions for new alliances and affinities which cross-cut conventional boundaries and relations between the state and civil society.

Important elements in the controversies over GM foods are echoed not only in specific, visible environmental debates around climate change, ozone depletion and biodiversity loss, but also in the reshaping of society-environment relations more generally. Evident are changing relationships between people and experts; a more tentative relationship between knowledge, innovation and policy; and new roles for governments, corporations, international organizations and citizen action in 'governing' the environment. Above all, such debates and controversies imply an appreciation of the social basis of environmental knowledges and the governance of environmental resources, and a sharp departure from the assumption that, once identified, the solution to environmental problems is essentially a technical matter (Benton and Redclift, 1994). These conditions now define the contours for both academic debates and practical actions around the environment.

The pervasiveness of these social ruptures and controversies could hardly have been imagined twenty years ago. As we outline below, the models for addressing issues of environment and sustainable development defined in the 1980s envisaged a world that operated very differently. The assumptions of these mainstream sustainable development agendas and their unravelling forms the focal story of the first half of this chapter. As we indicate, this unravelling has been partly caused by processes and events taking place in the world, and partly by the manifest failure of conventional models and associated policy options to deal with these. At the same time, analysts have observed these failures from the vantage point of a growing environmental social science, leading to fundamental critiques of the assumptions informing the broader programme of 'sustainable development'.

As we go on to suggest, the social science analysis which has helped to expose the shortcomings of the conventional sustainable development agenda has also begun to suggest new ways forward. It is these advances, coming

from different disciplinary angles and different foci – from issues of rural livelihoods in Africa or Asia, to debates over innovation policy in Europe and international responses to global climate change – which form the focus of this volume. We document in the second part of this chapter how a new synthesis is emerging, across three core themes: the negotiation of environmental knowledges; the application of notions of vulnerability, resilience and precaution in responding to environmental change; and the tension between local and global governance of the environment. Together these chart developments in an environmental social science while offering a highly illuminating lens for reflection on science, society and modernity.

ENVIRONMENT AND SUSTAINABLE DEVELOPMENT: THE MAINSTREAM AGENDA

A strong analytical and normative ‘programme’ emerged during the 1970s and 1980s concerning the nature of environmental problems and how to respond to them. Put briefly, science came to play a central role in revealing environmental problems, explaining their causes and providing the basis for defining solutions to them. These solutions would be carried out by government, normally national governments, but increasingly national governments co-operating through international regimes. State action was warranted because the environment was a public good which would be degraded without politically co-ordinated norms, rules and procedures to protect it. As an ever denser texture of formal controls was imposed on the use of the environment as both a resource and a sink, so the role of science grew in informing and justifying managerial and technocratic interventions by governments.

Other features of political and economic change supported this way of seeing and acting upon environmental problems. For instance, the internationalization of environmental governance, explained by the increasing recognition of the global nature of environmental problems, coincided with growing cooperation in other economic and political domains such as security, trade and investment, and at a time when roles were being defined for regional organizations such as the European Community. This in turn coincided with the rise of liberalization and market deregulation, leading to attempts to define environmental resources and services as goods that could be valued monetarily, and traded through markets.

In this context, a variety of analytical programmes – and modes of analysis to pursue them – emerged. One influential stream of work came from the sub-discipline of environmental economics. Hanley and Atkinson (Chapter 3) describe how this addressed the problem that the broad social and

environmental costs of economic activities were consistently undervalued, by developing ways to assign artificial prices to environmental goods and services, so enabling environmental externalities to be taken into account in economic decision-making. Economic valuation became central to a programme to reveal the hidden costs and benefits of policy decisions, to make environmental policy more rational, transparent and democratic, to include the value of natural resources in national accounting systems, and to ensure that inter-generational effects were highlighted (Pearce and Turner, 1990; Markandya and Richardson, 1992; Hanley and Spash, 1993; Hockenstein et al., 1997; Bateman and Willis, 1999). Economists also contributed policy options to help manage the market failures that were frequently seen to cause environmental problems, such as the Polluter Pays Principle.

A related analytical and policy programme saw environmental problems as resulting more from policy failures such as inappropriate legal frameworks, or tenure systems which gave producers incentives to pollute or to degrade resources (Repetto and Gillis, 1988; Jänicke, 1990; Weale, 1992). In order to put things right, it was argued, a planned set of policy interventions was required to bring economic and environmental goals into harmony. Sustainable development plans (and their many variants) were born, premised on the assumption that a co-ordinated approach to policy planning and implementation by national governments would achieve the sustainable development vision.

Attention also focused on the roles of both business and consumers in relation to the environment, and on the changes needed to 'green' their behaviour (Schaefer et al., Chapter 8; Burgess et al., Chapter 10). This agenda focused attention on the attitudes of managers and consumers to their environmental impacts, and on the right balance between regulatory and incentive-based policy instruments for influencing them towards more environmentally-friendly behaviour (Roome, 1992; Skea, 1995; Welford, 1998). Voluntarism and the role of incentives rather than penalties were emphasized as precipitating processes of learning and change by organizations and individuals.

Finally, global concerns such as climate change, loss of biological diversity, acid rain and desertification were seen to be beyond the scope of any national government to address alone. Instead, international co-operation between states was seen to be required, rooted in a common commitment to sustainable development (Levy et al., 1992; Vogler and Imber, 1996; Vogler, 2001). International treaties, conventions and protocols were developed, culminating in the 1998 Kyoto Protocol of the UN Framework Convention on Climate Change. In these conventions national governments were seen as acting in the role of 'global citizens' protecting international public goods, rather than pursuing their own unique national interests, as had been the case in

international trade and security regimes. In this sense, environmental problems extended the role and identity of the nation state.

Despite the wide variety of disciplines, concepts and analyses involved during this period, and the consequent array of definitions, indicators and methods, it is possible to identify a number of general features which united them, and characterized a dominant model of sustainable development to which they contributed. Environmental problems were analysed as being discrete, bounded and 'out there'. Their resolution relied heavily on technical expertise, whether of natural scientists, engineers or economists. Problems were portrayed as amenable to managerial solutions, whether by business, through national policy, or in the co-ordinated actions of the international community. As commentators on the notion of ecological modernization have observed, the programme was essentially for 'business as usual' only greener; and rested on fundamental assumptions that modernization and environmental sustainability could be rendered compatible through the exercise of reasoned action (Hajer, 1995; Mol and Spaargaren, 2000; Spaargaren et al., 2000). The language of zero-sum games and trade-offs was replaced by a language of 'win-win' and positive gains from environmentally-oriented change. The high point of all this debate was the UN Conference on Environment and Development held in Rio in 1992, when governments from around the world signed up to this vision with great fanfare.

But this was not the only vision. Other traditions of social science analysis picked up on different aspects of reality to construct different agendas, some of which became influential in defining alternatives to the mainstream. One important alternative had its roots in political economy and particularly in structural-Marxist analyses of economic systems, nationally and internationally. The work of Redclift (1984, 1987) and others pointed out that social and economic inequalities lay at the root of many environmental problems, especially in poorer and more resource-dependent societies (for example, Blaikie and Brookfield, 1987; Bryant, 1992; Peet and Watts, 1996). Such work showed that imbalances in exposure to environmental risks between the global north and south and within countries were to a large extent socially and politically determined. Other critics showed that many environmental issues (such as the destruction of fisheries, or the problem of waste) were the outcome of 'over-consumption'. This was frequently contrasted with resource use by 'indigenous' people who were seen as managing resources sustainably, while being marginalized by inequitable processes of economic growth. Without tackling systems and cultures of consumption in the developed world, there could be no mitigation of global environmental problems (Warde, 1990).

Still other critics argued that environmental problems at the heart of policy processes was virtual rather than real, and, in those cases where political

commitment had been engaged, this was explained by opportunities that existed to secure greater institutional power and legitimacy, rather than a new attachment to environmental objectives (Boehmer-Christiansen, 1994). One line of critique suggested that solutions to environmental problems required a more fundamental reordering of political economy, evidence of which they saw in the emergence of new global civil society organizations which came to challenge national governments as the sole representatives of the public good (Princen and Finger, 1994; Wapner, 1996; Jamison, 1996). New spaces for political alignment and activity on environmental questions were being opened up at different levels of governance, from the local to the global, sometimes contesting the positions of government, and at other times enabling them to act. Versions of this vision chimed with the agendas of certain NGOs (for example, those starting to advocate indigenous people's rights) and with 'southern' responses to the mainstream sustainable development agenda (for example, in the Indian Centre for Science and Environment's portrayal of responses to climate change advocated in the West as 'northern imperialism') (Agarwal and Narain, 1991; see also Gupta, 1995). Yet, despite these differences, some common assumptions were shared between the mainstream sustainable development model and these critics: environmental systems were viewed as relatively stable and knowable; environmental problems were seen as being defined in technical terms with solutions informed by conventional technical expertise; and economic growth, albeit with its fruits more fairly distributed, could be reconciled with the maintenance of environmental services. These assumptions were all to come into question. This new questioning would bring other dimensions of social science work into prominence.

THE 'UNRAVELLING' OF THE MAINSTREAM AGENDA

During the decade following the 1992 Rio conference highpoint, the weaknesses of the analytical and policy 'programme' that it expressed have become increasingly apparent. Even if much has changed for the better, the formula that science reveals, states coordinate and incentives push private actors to enact solutions to environmental problems has proved incapable of achieving its goals. The vision of using economic and legal instruments to manage technically-defined environmental problems in the interests of a common good has been challenged. What we have termed 'mainstream' sustainable development encountered many difficulties both in analysing environmental problems and in implementing preferred courses of action. From a long potential catalogue of such difficulties, we choose just a few to illustrate how the mainstream agenda unravelled.

Science–Policy Relationships Questioned

While environmental problems were typically ‘objectified’ as stable and observable, it has become increasingly clear that definitions of environmental issues are not stable across different social groups, and vary even between groups of experts (Stirling, 1998). The long-standing critique of sociologists that controversies about the environment characterized as debates about risk really reflected conflict between different social and institutional commitments and values has become increasingly evident. Related to this, the capacity of scientific advice to provide unambiguous analysis and recommend effective action has been challenged by evidence of the uncertainties and indeterminacies that pervade both analysis and action (Wynne, 1992, 1996).

Failures of International Environmental Regimes

In many respects, the high hopes of a decade ago for a new form of global environmental governance have not been met. New international regimes have been difficult to put in place, while many of the new institutions and mechanisms have proved cumbersome, ineffective at ensuring compliance, and vulnerable to charges of unaccountability and non-representativeness. Accusations of unfairness have also been made, particularly by those in developing countries who see much of the international environmental agenda as being driven by northern interests. Thus a major threat to new forms of international environmental governance has been one of marginalization – especially from agreements about trade and economic co-ordination. At the same time, it has become evident that, for all the normative appeal of co-operative solutions to global problems, they are doomed to failure where these solutions do not also correspond with the broader economic and political interests of more powerful states.

Political Costs of Incentive-based Solutions

The idea that the costs of using environmental services should be fully expressed and borne by the user of those services is long established. Much effort has been focused on defining the environmental value of economic and social activities (Costanza et al., 1993), and to redefining environmental property rights (Jacobs, 1994). However, these have been hampered by methodological disputes about how to establish monetary values for the environment and by political difficulties in distributing the rights and costs (from carbon taxes to tradable permits). While there has been much experimentation with market-based instruments, they appear to be appropriate

and effective only in rather specific circumstances (Gunningham and Gabrosky, 1998).

Paradoxes in 'Greening' Business

While many companies have begun to integrate sustainability considerations into their strategy, management systems and decisions, few regard them as central concerns (Fineman, 2000). Many companies, especially smaller ones, still do little more than comply reactively with minimum standards and regulations. The supposed link between innovation, resource productivity and competitiveness appears not to hold in many business contexts, so that predictions of a broad ecological modernization of business have not been borne out in practice (Schaefer et al., Chapter 8). The green consumer, while significant in some markets, has also proved to play a smaller role than expected. There is often a gap between a stated desire for a cleaner environment and the behaviour of consumers in buying, using and discarding products (Burgess, Chapter 10). Moreover, the consumer and the lifestyles supported through modes of consumption have themselves become a focus of analytical and policy interest as more has been understood about the spread of environmental impacts along product systems from 'cradle to grave'.

Challenges to National Governments

As the limits to policy action became clearer, as the distributional consequences of many environmental policies became more obvious (locally, nationally and internationally), and as the capacity of governments to define and exert control over environmental problems faltered, the role of government as the primary actor in environmental policy came to be questioned. More and more, governments have come to be seen, and to see themselves, as participants in more complex and multi-layered processes of deliberation and environmental action (Munton, Chapter 4; Vogler and Jordan, Chapter 5). This has called into question the notion of 'the public good', the way it should be defined, and how to achieve legitimacy and distribute the benefits of positive environmental change.

Resistance to Imposed Plans

Despite a growing rhetoric encouraging local participation and public consultation in the development of plans created in the name of sustainable development, very often such efforts have proved limited and perfunctory. Instead, as with previous attempts at planned intervention, a particular

vision has been imposed. Whether involving the redesign of urban landscapes in Europe or environmental rehabilitation in Africa, such plans have carried with them certain assumptions about how people and the environment should live and interact (Leach and Mearns, 1996). Sometimes these were not shared by local inhabitants, and just as previous plans had been, sustainable development plans have not been immune from various forms of resistance, both covert and open, by people in their communities.

Social Difference and Environmental Justice

While the sustainable development agenda tended to map fairly uncritically a simple relationship between people and resources, in practice social differentiation and dynamics have proved critical to influencing who gets access to which resources. A clearer understanding of the multiple dimensions of social difference – by age, gender, wealth, class, race and so on – shows how environmental impacts are felt far from evenly. Issues of inequality of access and inequality of impact have highlighted the importance of environmental rights and justice (GECP, 2001b).

A CRISIS POINT? THE EMERGENCE OF AN ALTERNATIVE AGENDA

In a range of key areas, environmental social science work over the past decade has drawn attention to these and related difficulties. Taken together, it reveals how the mainstream sustainable development model of the 1980s is no longer well-matched with the contemporary dynamics of social, political and scientific processes in their engagement with dynamic natural systems. This explains why the model has struggled to deliver effective and legitimate policy solutions and to inform the processes of learning necessary to address the complex and interconnected problems.

The unravelling of the model suggests something of a crisis point for mainstream environment and sustainable development agendas: a crisis both in the analysis that informs them, and their policy prescriptions. Such a crisis is far from unique to the environmental field. Many authors (Beck, 1992, 1995; Giddens, 1991; Adam et al., 2000) have argued that the crisis besetting conceptions of the environment is symptomatic of a broader crisis of positivist, technocratic and managerial approaches in the face of the conditions of 'late modernity'. But while such a crisis is more general, there are also important ways in which sustainability as a political and rhetorical arena brings it particularly clearly into focus, and amplifies some of its dimensions. Put another way, there are a number of reasons why environmental issues

invite the kind of social science which has proved particularly revealing of these contemporary issues.

A focus on the environment invites a problem-focus, in which multiple disciplines are brought to bear on a given issue, encouraging a potentially fruitful blending of perspectives. It also requires an engagement with natural, biophysical processes – therefore bringing social science into engagement with natural science debates which have been re-characterizing systems as uncertain, dynamic, and scale and path-dependent (Scoones, 1999). In addition, environmental issues confront head-on conflicts between public and individual goods – and hence questions about who defines public goods and the public good, about the social differentiation of access to resources, and the power relations that define them. Issues of environmental change increasingly must address global and cross-border effects, across a diversity of localities, identities and capabilities. This means that environmental issues challenge governance across different scales in a globalizing world. Finally, ‘the environment’ has become a label, a signifier of public consciousness, and of individual and collective reflexivity, leading to a variety of forms of political action, which disturb conventional boundaries and ways of thinking (Dobson, 1990; Grove-White, 1993; Yearley, 1995; Szerszynski, 1996).

Over the last decade environmental social science has made a significant contribution to developing our understanding not only of environmental issues per se, but a range of broader questions. Environmental problems have recently provided – and will continue to provide – a revealing lens through which to view and reflect on these emerging and fast changing contemporary conditions. In the following sections we highlight three areas where important advances have been made. The first area focuses on the challenges of dealing with complex and uncertain environmental problems, and the implications this has for expert institutions, decision-making and policy processes. The second area focuses on the particular challenges of global environmental governance, and the challenges which have emerged around new international environmental regimes and between environmental and trade regimes. The third area traces debates about sustainable production and consumption and the challenges this presents for business and regulation, as well as lifestyles and livelihoods. Together, this work questions the mainstream sustainable development agenda in quite fundamental ways, and begins to forge a new set of agendas, ones that resonate with wider analytical and policy concerns.

SCIENCE, KNOWLEDGE AND UNCERTAINTY

During the last ten years, uncertainty has been identified as a distinguishing characteristic of environmental change and policy. Environmental effects are

usually complex, long term and uncertain; trade-offs between choices may be unclear; perceptions of both problems and solutions are value-laden and differ greatly amongst different social groups. The emergence of new technologies, such as genetic engineering, and large-scale environmental problems such as climate change, have deepened these uncertainties. Many environmental systems involve inherently unpredictable changes, or are too complex to be fully understood, at least in the foreseeable future. Time and space gaps between causes and effects are typical for environmental problems and increase these difficulties. Yet, despite this, as environmental social science research has illustrated, processes in the production of scientific knowledge and its relationship to policy have tended to preclude full representation of such uncertainties (Taylor and Buttel, 1992).

Global climate change can illustrate these difficulties. Understanding of the interaction between the factors influencing our climate remains incomplete and is permeated with uncertainties. It is difficult to project how greenhouse gas emissions would affect future atmospheric conditions. There will be as yet unknown feedback effects and unexpected regional effects. How future climate change will affect human life in twenty or forty years is to a large extent unknowable – social and economic forecasting is hampered by the combination of reflexivity, adaptation and surprise (Berkhout, Hertin and Jordan, 2002). However, policy-makers demand answers to these questions to guide their decisions and typically they turn to science. Scientists have attempted to satisfy these demands and to project future climate change as well as its possible effects. Within the politically influential Intergovernmental Panel on Climate Change a substantial consensus has built up, not only with respect to scientific findings but also to research approaches (IPCC, 2001). Climate change models combined with economic cost-benefit analysis have become the dominant methods. These in turn have a strong influence on national and global climate policies about how and when to respond to the possible causes and impacts of climate change (Shackley and Wynne, 1995).

Over the last decade, however, there has been an intense and controversial debate over the limits of standard valuation and risk assessment techniques. While methodological refinements to such approaches have developed rapidly, partly in response to critiques by economists themselves of the first generation of studies (Hanley and Atkinson, Chapter 3), such technically-driven decision approaches confront more fundamental, conceptual challenges. First, valuation requires firm, high quality data on environmental processes. Where conditions and outcomes are uncertain (where we don't know the probabilities of possible outcomes) or, perhaps more troublesome, where ignorance is prevalent (we don't know what we don't know), then many conventional approaches founder. As Stirling (Chapter 2) discusses, standard

environmental decision-making tools may be misplaced under circumstances where uncertainties dominate. Indeed, it is precisely when such 'hard tools' are applied to uncertain environmental issues that 'soft disasters' such as BSE, radioactive waste management and GM foods regulation have arisen; political crises due to the erosion of public confidence and legitimacy (GECP, 2000a).

Second, other challenges relate to moral and ethical concerns with justice and equity: for example, is it legitimate to measure the value of, say, a lake, only in relation to its economic benefit for local swimmers, sailors and fishermen? Does nature not have values independent from human use? Is 'willingness to pay' an appropriate concept where consumers are actually unable to pay? In short, the question has been raised: are valuation techniques as objective, neutral and democratic as they are sometimes claimed to be?

Third, an acknowledgement that scientific research approaches and findings are not independent of political and institutional contexts has been an important theme of social science research. The traditional, linear model of policy drew a clear line between science and policy. In this view, research supplied objective and secure knowledge on the basis of which policy made value- and interest-based decisions. However, in reality, the line between science and policy is inevitably blurred, and scientific and policy processes are frequently co-constructed (for example, Jasanoff and Wynne, 1997; Keeley and Scoones, 1999).

These debates have, in turn, fed into questions about expertise in environmental decision-making. Policy decisions are usually strongly influenced by the advice of experts. However, the authority of scientific expert knowledge has been contested over the last decade, particularly in the area of the environment (Irwin, 1995). The perception of expert knowledge as being value neutral has been questioned because scientific approaches and results reflect in some way value judgements and underlying assumptions about society, and because these in turn are related to the particular positions, locations and interests of expert institutions. Value judgements play a major role in many questions relevant in environmental science: which health risk can be regarded as tolerable? How should local and global pollution effects be weighed against each other? To what extent should future ecological damage be considered in today's decisions? Scientists are not necessarily experts on personal, ethical and moral matters – so why should they have a privileged say in the weighing of these factors? Social scientists have, at the same time, emphasized the existence and value of many alternative forms of expertise, be they 'indigenous knowledges', 'lay expertise' or 'citizen science' (compare Richards, 1985; Warren et al., 1995; Scoones and Thompson, 1994; Fischer, 2000). Such knowledges are embedded in cultural assumptions and socio-

political values which may contrast strongly with those of experts. Moreover, the failure of expert-based environmental policies and the social resistance they have encountered has thrown into question the role of mainstream scientific advice and lent greater force to arguments to take alternative knowledges (including social science) more seriously. Neither scientific expertise nor local knowledge can, of course, claim to be uniquely true or objective. Rather, different people and institutions start from different assumptions, perceptions, values, interests and knowledges (Agrawal, 1995; Murdoch and Clark, 1994). There are many ways of framing environmental problems: as problems of technocratic control; as problems of moral significance; as problems of entitlement for different groups in society. The challenge is to bring these orthogonal and competing framings together in a constructive way, while taking account of the power relations between those who hold different types of knowledge.

When major uncertainties over environmental outcomes prevail, and when public perceptions diverge significantly from expert opinion, trust becomes a key issue in policy-making. While decision-makers are usually aware that public confidence is the basis of successful policy, they have often failed to gain or preserve such confidence because they did not invest in building up trustful relationships. The issue of trust applies to many environmental areas, but is highlighted particularly vividly by the case of GM foods. On this issue, the gulf between the perceptions of policy-makers and the public grew to such an extent that profound misunderstandings have taken place. Politicians apparently failed to understand hostile public reactions to genetically modified foods, considering them misinformed and emotional. Among the public, however, mistrust of governments, companies and experts involved in environmental decision-making has continued to grow. Instead of relying on claims of safety, many people prefer to hold on to the right of choice. Another recent example in the UK has been the controversy over child immunization.

The main reason for this distancing between publics and policy-makers can be found in the nature of decision-making and communication processes. Policy choices are increasingly made on the basis of formal appraisal techniques. These focus on technical issues and often fail to reflect adequately the variety of social contexts in which choices are played out, wider public concerns and fundamental ethical questions. But who is the public? The public is in fact deeply fragmented, formed by people and groups with diverse, and possibly mobile, social backgrounds, interests, knowledges, attitudes, values and perceptions. Public trust therefore has many dimensions and cannot be achieved with a uniform strategy of communication seeking only to build a requisite level of consent for government policy. Trust depends, to some extent, on truth claims and on the capacity to validate them. In the absence of

a means of validation, the authority of policy-makers and industry falls into sharp decline. Instead, re-building consent and trust in public institutions is recognized to require a public-policy dialogue addressing different concerns and diverse publics. While the decline of public trust has been reinforced through political and policy failures, it is primarily driven by deeper trends within society. Even as social reality for many people in the industrialized north has become more secure, the desire to control the risks that remain has apparently grown. Many people have become more cautious and critical concerning social institutions generally. For many groups in the developing south an opposite problem has arisen in respect of the deeply disruptive effects of processes of modernization which introduce new social risks and cleavages. In both these contexts, trust in public institutions and in their expertise cannot be restored in an absolute and unconditional fashion. Instead, it has to be continually built and re-built in an ongoing process. Regaining trust requires not only better institutions and new scientific knowledge, but also greater openness about risks, uncertainties and ignorance. There is therefore a role for new forms of policy process, which encourage greater transparency and inclusion, thereby creating conditions for greater trust in outcomes.

In response to these challenges, environmental social science has begun to investigate and innovate a range of approaches that encourage integration and inclusivity in decision-making. This includes integration of knowledge and expertise through interdisciplinary styles of research which acknowledges a range of different 'scientific' and 'lay' expertises. It also involves approaches which facilitate direct citizen involvement in environmental decision-making, such as the range of 'deliberative and inclusionary processes' (DIPs) reviewed here by Munton (Chapter 4).

So where has a decade of research on uncertainty and environmental decision-making got us? The journey has begun towards approaches which deal better with uncertainties that face social scientists, other specialists, decision-makers and the public. As the pace of environmental change and of scientific inquiry speeds up, so it becomes more urgent to develop approaches which can prevent contentious policy issues from degenerating into crises of public confidence. This will apply as much to environmental issues as to other areas of public policy. Amongst the many challenges ahead are how to combine quantitative and qualitative knowledge in ways appropriate to a broader range of social settings. Attempts to build trust amongst expert institutions and publics must deal with multiple audiences who may have quite different perspectives and opportunities to stake their opinions and claims. And co-existing with these social differences are relations of power between expert and citizen institutions. Alongside innovations in the toolbox for environmental decision-making, then, issues of power, equity and social context remain among the key challenges to be addressed.

WHO GOVERNS THE GLOBAL ENVIRONMENT?

Challenged by the slow progress and failures of international regimes, environmental social science researchers since the mid-1990s have been rethinking the question of how the global environment is – or should be – governed, from the perspectives both of effectiveness and fairness (GECP, 2000b). The proliferation of international agreements has led many researchers, as discussed by Vogler and Jordan (Chapter 5), to examine the functioning of agreements and the informal rules and procedures which surround them. Empirical studies have shown that the success of international regimes, although difficult to measure, varies greatly. For example, the regime on tropical timber is widely seen as a failure, while the agreement on stratospheric ozone is usually presented as a case of successful international policy-making. Some cases seem to confirm a pessimistic viewpoint: negotiations are arduous, states do not comply with agreed measures, monitoring is poor and effective sanctions are rarely put in place. In other cases, regimes have a number of indirect positive effects. They draw attention to a problem, contribute to a shared understanding about causes and effects, and lead to the improvement of institutional structures in a specific area. In the last decade environmental social science researchers have studied and compared different regimes to find out how success and failure can be explained, and how future agreements should be designed.

The success of international environmental regimes cannot be attributed to a single factor and the appropriate structure depends on the situation and the specific issue. However, a number of elements can be identified which improve the efficiency of environmental regimes. These include: (1) rules that ensure a fair distribution of costs and benefits, for example, through differentiated obligations for developed and developing countries, financial aid and technology transfer for poorer countries; (2) strong but acceptable non-compliance mechanisms which should embody ‘carrots’ (for example, advice and financial aid) as well as ‘sticks’ (for example, suspension of voting rights, denial of benefits, eventually trade sanctions); and (3) a strong institutional structure, including a secretariat well articulated with the science-base, holding regular scheduled meetings of the parties, mechanisms for monitoring compliance and harmonized reporting and data collection.

However, the direct effects of these formal procedures are only one aspect of regime effectiveness and other factors play an important role. Regimes cannot only give material incentives for co-operation but also shape the ways in which actors define their interests. For example, actors can choose to gain long-term political credibility by committing themselves to ambitious environmental policies, rather than trying to maximize short-term financial benefits. Regimes have also contributed to building trust between the parties

and to improving their capacities to carry out effective policies. Although these outcomes are indirect, they can be encouraged by careful design of rules and procedures. Suggestions to enhance social learning include: procedures for revising regime procedures and commitments; implementation review processes which identify and help countries with difficulties to fulfil their obligations; transparent monitoring rules and conflict mediation processes aiming to build trust; and independent bodies providing scientific, technical and economic advice.

Given that countries invest different interests in environmental problems, only those agreements that confront the problem of fairness will gain wide support. General acceptance of the legitimate social priorities of poor countries, however, does not define a 'fair' international agreement. Negotiations on a climate change convention offered a remarkable example of how fundamental questions of justice translate into practical political questions: how should levels of carbon emission levels be established? Should the aim be to have similar levels of emissions per head of population or should all countries be obliged to make a similar effort? Should industrialized countries be accountable for their 'historic' emissions over the last hundred years? Several environmental regimes have sought to address issues of fairness. For example, the Montreal Protocol on ozone depleting substances imposed stricter obligations on developed than on developing countries. It also established a multilateral fund, which compensates developing countries for complying with the protocol because those who joined the agreement should not be worse off than those who remain outside. On the other hand, there are many barriers to these mechanisms, and their effects so far are mixed.

In the last decade, extensive research has shown how international trade systems have considerable effects on the potentials and limits of environmental protection (Ekins, Chapter 6). Those concerned with the environment have two main concerns: will an increasingly free flow of goods and services undermine national environmental policies? Could a dominant global trading system undermine the effectiveness of international environmental agreements?

The first concern assumes that global trade liberalization allows companies to gain competitive advantage by re-locating their production sites to 'pollution havens' and selling their products to countries with stricter environmental policies. This could prevent governments from taking environmental measures and encourage an ecological 'race to the bottom'. If countries were not allowed to impede the import of 'dirty' goods, national environmental policies would displace polluting activities internationally instead of reducing them. Considerable research effort has been devoted to finding out whether theory is borne out in practice (Vogler and Jordan, Chapter 5). The overall conclusion is that the potential for 'ecological dumping' depends on the

specific conditions in countries, sectors and companies. The environmental impact of international trade should not be over-estimated but it is a matter of serious concern. Trade agreements that remove obstacles to the exchange of goods and services between countries, for example, those overseen by the World Trade Organisation (WTO), still operate largely independently of environmental and social considerations. This separation leads to inefficiencies by lowering the effectiveness of national and international environmental policies. An increasing number of actors, not only environmental groups, but also governments and international organizations such as the United Nations Environment Programme, call for further integration of environmental and social concerns in world trade regimes. A number of suggestions have been made to achieve this, such as drawing a clearer distinction between legitimate environmental requirements and unfair trade barriers.

The second concern refers to environmental regulations on the international level: who makes international environmental rules and do they take precedence over other principles and rules? In some cases, there are potential conflicts between international environmental agreements and WTO rules, as in, for example, the Cartagena Protocol on Biosafety. This highlights the need to clarify the relationship between environmental agreements and trade regimes. Free trade should not prevent the establishment of legitimate environmental regulations on the international level. If international mechanisms are often not up to the task, and national governments have few incentives to 'go it alone', then how should global environmental problems be dealt with? These questions reflect a changing reality in which, as discussed by Vogler and Jordan (Chapter 5), governance structures have gradually become more dispersed. Nation states have lost some of their capacity to exercise power directly and autonomously. Local, regional and international institutions have gained prominence, as have non-state actors such as semi-autonomous government agencies and NGOs (Newell, 2000). This tendency is partly due to an acknowledgement that increasingly complex and inter-dependent political, economic and social systems cannot be governed from a single level.

One important realization – highlighted by research from across the world – has been that many global environmental issues are best dealt with at a local level. This is true for activities aiming to prevent pollution, but particularly important for local-level adaptation to global environmental change (Adger, Chapter 7; Adger et al., 2001). For example, the effects of climate change are felt at the local level – more flooding, more frequent droughts, warmer winters and so on – but floods, droughts and winters have always occurred, perhaps not with such frequency or severity, and mechanisms for coping exist. A recent focus on local conditions comes from the study of the impacts of and responses to environmental change on natural and social systems. This builds on earlier findings that environmental crises are often not so much caused by

natural events as by political or socio-economic circumstances, including inappropriate government policies, distorted economic structures and poor resource management. These institutional factors appear to be the main causes of human vulnerability to environmental change. Nurturing the local capacity to build institutionally-grounded resilience is often a more effective policy response than providing for international crisis relief. Local adaptive capacity will be central to the multiple responses necessary to the impacts of long-run environmental problems such as climate change. The challenge, then, is not to see global environmental change as somehow different, but as presenting another reason to support institutions which help people cope and adapt, reducing their vulnerability and increasing resilience (Berkas and Folke, 1998).

In today's interconnected, globalizing world, a wide range of different players influence local action from beyond local arenas. The answer to the question: 'who governs the global environment?' must look at interactions between multiple actors and multiple levels (Mehta et al., 2001). Much of the early debate about international environmental agreements was predicated on the assumption that states and governments were the sole parties to global governance arrangements. While NGOs, business interests, and public interest groups were involved in elements of global convention processes, it was governments who signed up and were expected to implement the agreements. But, as Vogler and Jordan (Chapter 5) discuss, without the backing of others, governments are increasingly unable to frame and to see through such commitments. Governments will therefore come to share decision-making and implementation with many partners. This will also force environmental governance to become more dispersed to both international and sub-national levels. Experience at the Johannesburg Summit bears out this trend.

Thus research over the last decade has shown both the potentials, but also the severe limitations of an international approach to global environmental issues. Reflections on this experience have pointed to important new directions for global environmental governance. The debate has moved from a focus on the state to a multitude of partners, including a wide range of civil society and business organizations; from the international level to governance on different levels; from a predominantly environmental focus to a more integrated approach; and from a largely formal, legalistic process to a more open and participatory response. Many challenges remain: identifying the appropriate level(s) of problem solving will become increasingly important, and attention will need to be paid to the interaction between multiple levels of policy-making, for example, between global environmental regimes, national governments and local communities. Knowledge and other resources will need to flow between these levels as a way of building capabilities and commitment. The new pluralism also raises questions about the legitimacy of

the political influence of NGOs, corporations and other groups. Processes will need to be developed that ensure that new processes of multi-level environmental governance also become more transparent and accountable.

PRODUCTION AND CONSUMPTION, LIFESTYLES AND LIVELIHOODS

Environmental social science research has played an important part in debates about the role of business in environmental management and the ways in which policy can influence systems of production. More recently, the role of consumers and their lifestyles has been recognized as critical, with debates focused on northern industrial contexts showing certain parallels with, but also important differences from, those on 'sustainable livelihoods' in the south. Across the board, there has been an emphasis on more systemic approaches, and on innovation and learning as a way of reconciling economic development and sustainability (see Berkhout and Gouldson, Chapter 9; GECP, 2000c).

Debate about the effects of economic growth on the environment has long been polarized. On the one hand, there are those who argue that growth brings prosperity, changes in the structure of industry (the shift from manufacturing to service-based economies), new technology and social expectations that enable societies to invest in improving their natural environment. Environmental problems, they argue, can only be handled within dynamic, innovative, prosperous and trading economies. This perspective has been supported by empirical studies that have found a link between indicators of environmental quality and the average wealth of countries (Grossman and Kreuger, 1995; Jänicke et al., 1989). Wealthier countries tend to have cleaner local environments, and this seems to suggest that growth and environmental protection can be achieved together.

On the other hand, critics argue that wealthier economies consume more natural resources and contribute disproportionately to larger-scale environmental impacts such as climate change and the destruction of biodiversity. They argue that there are limits to the consumption of environmental services beyond which they will be threatened and the overall welfare of people will be at risk (de Groot, 1992; Daly, 1994). Merely encouraging growth is not enough. What matters more is the rate and direction of economic change, with technology playing a critical role. Today, most critics do not argue for 'limits to growth', the debate has rather been about the nature of growth. Economic growth may be reconciled with environmental protection, but only under special conditions.

Because research suggested that there was great potential for economic measures benefiting the environment, there was much expectation that

business, once it was aware of these opportunities, would take a lead in the transformation to a sustainable economy. There has indeed been considerable change over the last ten years. Many progressive companies have adopted a more pro-active attitude towards the environment and sustainability, and developed new organizational capacity and routines (Berkhout and Howes, 1997). Environmental management systems are widespread in larger companies, environmental reporting is improving and levels of pollution in some industrial sectors fall considerably below the levels mandated by regulation. Leadership companies are now seeking to develop business strategies that combine social, economic and environmental goals (de Simone and Popoff, 1997; Hawken et al., 1999). This can partly be explained by economic rationality, including savings from more efficient use of resources and indirect gains from better risk management. Businesses are increasingly expected to share broader social responsibilities that go well beyond their role in producing and selling goods. Social pressures (from customers, lenders, regulators and NGOs), as well as new market conditions, are radically changing the conditions under which business operates. For reasons of internal cohesion (through a statement of corporate 'values'); survival in a more global market in which signals to investors and customers are attenuated (hence the growing importance of 'brands'), and in order to take opportunities in a new 'regulatory space' opening up as governments look for partners in the practice of governance, companies are being both pushed and pulled towards a broadly-defined corporate social responsibility (Berkhout and Hertin, 2002). These changed conditions and imperatives have implications for the ways in which the behaviour and boundaries of firms are thought about.

Yet, as Schaefer et al. (Chapter 8) show, the greening of industry is not universal and is a much more problematic process than many had expected. Technical potentials for environmental innovation are rarely exploited fully and a considerable number of companies do not even comply with existing standards and regulations. The majority of firms still have a reactive attitude towards regulatory and other pressures. Environmental initiatives, be they national or international, often face strong opposition from business lobby groups. Where alignment of business and environmental strategy has occurred, there are often rather specific reasons connected to the market and regulatory context, that are hard to generalize about (Howes et al., 1997). In addition, the search for more sustainable technologies and ways of doing things is fraught with uncertainty: (1) about the resource and environmental performance of technological alternatives (including the potential for undesirable impacts); (2) about trade-offs between varying impacts of the alternatives; and (3) about the dynamics of relative costs and benefits of alternatives over long periods (including learning effects and the impacts of changing regulation) (GECP, 2001a). These conditions mean that the

'optimality principle' invoked in much economic literature is being replaced by a greater concern with adaptation and learning along open-ended innovation pathways, invoking more qualitative principles such as diversity, reversibility, flexibility, resilience and precaution. Much effort is being devoted to the clearer definition of what these principles may mean in practice (Stirling, Chapter 2).

Because levels of environmental awareness are high in northern societies, buying and consumption habits were also expected to change. This has been demonstrated for some products such as organic food, which have found their place on the shelves of large supermarkets. Generally speaking however, 'green consumerism' remains a niche in most markets, even if it can be a significant one. There are examples (detergents, white goods) of whole families of products whose environmental performance has been positively influenced by the process of competition from new 'green' entrants on the margins. On the other hand, it is widely known that there is a dissonance between the environmental awareness of consumers and their behaviour (Burgess et al., Chapter 10). One explanation of this is that the analysis of consumption behaviour cannot begin from the presumption of an unbounded consumer rationality and sovereignty. Instead, much consumption behaviour has to be seen as 'constructed' out of the conventions, knowledges and opportunities that are open to consumers (Warde, 1999). Decisions about what to buy and how to use products are dominated by criteria such as functionality, price and quality. Policies for sustainable consumption have to acknowledge the limited success of past initiatives based on information and voluntary action. Instead, priority should be given to strategies that loosen the bonds of constructed behaviours, of broadening the range of alternatives that are made available, of shaping these to the consumer's expressed needs and desires (given that consumption is also a symbolic act; Miller, 1995), and of reducing the 'switching costs' that may act as barriers to a desired alternative behaviour.

Environmental social science research has identified other barriers to environmentally-aware consumer behaviour. Because shopping, driving and housekeeping are made up of innumerable small and isolated activities, people often feel that their individual decisions do not make a difference. Typically these activities also have a social value to consumers. Citizen-consumers are often sceptical as to whether government and business can be trusted to promote the sustainability of their way of life and expectations. Government attempts to encourage individual behaviour change will suffer unless supported by clear economic and other incentives. To overcome the public sense of powerlessness, strategies for more sustainable consumption need to focus on areas where consumer behaviour makes a noticeable difference and where production-oriented policies are less effective (Burgess et al., Chapter 10).

A parallel, but quite different, set of environmental social science debates has addressed people's behaviour and its impacts in rural settings in the south. In contexts where people (as farmers, pastoralists, forest and water users, and so on) are both producers and consumers, in ways only partially mediated by market relations, research has addressed the relationships between people's well-being (material and otherwise) and their use of environmental goods and services. It was initially supposed that population levels and technology accounted for environmental impacts (for example, UNFPA, 1991). Direct links were also drawn between poverty and environmental degradation, the assumption being that poor rural people would have no choice but to 'mine' environmental resources to survive (for example, Durning, 1989). However, numerous cases exist where local people effectively conserved and enriched the environment despite demonstrable material poverty and population growth (for example, Fairhead and Leach, 1996, 1998; Tiffen et al., 1994, Sillitoe, 1998; Scoones, 2001). Moreover, people's behaviour and its environmental impacts were shown to be influenced by a wider range of mediating factors, from knowledge and values, social difference and dynamics, and institutional and policy arrangements governing both access to and control over resources, to the terms on which technologies are employed (Adger, Chapter 7; Leach et al., 1999). In these respects, contemporary perspectives on 'sustainable livelihoods' in the south (Scoones, 1998) converge with northern work on sustainable lifestyles and consumption in emphasizing the broader institutional and policy processes that shape individuals' and groups' behaviour, and the need to address strategies for change towards these.

The greening of consumption, production, lifestyles and livelihoods has proved to be more arduous and challenging than was hoped for a decade ago. Despite the efforts of many organizations and a long tradition of environmental regulation, many environmental problems (biodiversity loss, the spread of toxic substances and climate change) continue to be of serious concern to many, and new ones are likely to emerge (endocrine disruptors, gene transfer between GM and non-GMOs). This points up two fundamental problems in the debate about the two-way links between business, technology and the environment. The first concerns the embeddedness and path dependency of many technological regimes, and the extent to which these regimes can be modified to be more sustainable. A better course may be to abandon an incumbent regime and manage a transition to a radically new way of meeting expressed social and economic preferences. Can a regime be changed from within, or should policy be directed at achieving a regime shift? The second, and linked, question concerns the nature of the technology, market and institutions which should replace prevailing 'unsustainable' models. The assumption, often held by advocates and critics alike, is that the costs and

benefits of new regimes can be known, and that the problem, once a desired alternative has been identified, is one of implementation. However, this faith in foresight often turns out to have been illusory (Anderson and Cavendish, 1999). The history of technology tells us that the costs and benefits are often only very incompletely known at the outset. A putatively more sustainable technological path may, with hindsight, reveal new social and environmental costs, and display the same characteristics of economic and social 'lock in' as the system it replaced. How then can this be avoided, and what principles can we define that may make future technological developments more adaptive and resilient?

Even if it were possible to define a preferred development path to take, another important question concerns the means of achieving it. Beyond the pressures and imperatives that are reshaping business responses to sustainability, the role of public policy clearly remains critical. Over the last decade there has been an intense debate about the correct choice of policy instruments that may induce changes in production and consumption towards more sustainable paths. One striking development has been the marked broadening of the instruments considered, experimented with and introduced (Smith and Sorrell, 2001). A focus of research on policy processes has pointed up the limits of traditional 'command and control' regulation that sets standards or imposes bans. Economists have long argued that direct regulation is inefficient because it is uniformly applied, 'freezes' standards, and is usually based on the regulator's imperfect knowledge of the potential for and costs of improved environmental performance. This critique has been broadly accepted, and has underpinned the justification for a shift towards a wider portfolio of policy instruments, including market-based and information instruments and voluntary approaches. By creating economic incentives for businesses and consumers to change their behaviour these instruments should promote innovation and efficiently distribute effort among the regulated. Voluntary or negotiated agreements – commitments between government and industry to achieve defined environmental performance targets – are another way of trying to create incentives and new norms. In practical political terms, however, they are often hard to implement. More recently, there has emerged a greater interest in the broader link between environmental and innovation policies (GECPa, 2001). In this analysis, the generation and take-up of new technical knowledge and technological systems is intrinsically long-term and uncertain, represents a public good and therefore needs to be supported by public policy.

Over the past decade, then, the debate about business, technology, policy and the environment has been transformed, and produced new paradoxes. Even as the inflexibility of many technologies, business practices and consumption behaviours has been revealed, so has the need for more profound and

systemic shifts in technologies, infrastructures and lifestyles (Kemp et al., 1998). Rather than relying on the rational pursuit of self-interest by single actors, a new geometry of environmental governance has emerged, including business (perhaps with a broader definition of its social responsibilities), policy-makers, consumers and civil society. In order to encourage movement towards more sustainable systems of production and consumption, policy instruments need increasingly to emphasize incentives, innovation and learning between actors.

A REVITALIZED SOCIAL SCIENCE OF THE ENVIRONMENT?

Looking across the bodies of work reviewed above, it is worth asking to what extent it is possible to identify a reconfiguration in the social science of the environment? We want to suggest that there are a number of important themes which cut across these different domains, and which studies across different domains, issues and locations pick out. These are not coherent enough to constitute a new 'programme' or 'model' in the sense of the 1980s sustainable development agenda we described earlier. Indeed it would go against the grain of recent social science analysis – and its characterization of contemporary societal conditions – to suggest that such singularity is possible or appropriate. Equally, these themes currently take the form more of common questions than of well-defined avenues of research interest and activity. Nevertheless they reflect framings of issues through which emergent strands of social science are confronting, reflecting on and engaging with the contemporary world and carrying implications forward practically.

Negotiating Knowledges: Science, Risk and Expertise

New risks generated by rapid economic and technological change are a pervasive feature of public and policy discourses. As discussed above, there is growing evidence of public mistrust in 'expert' institutions as these are variously seen to generate risk, to be guided by politically and economically-embedded science, and to lack legitimacy to address problems in ways meaningful to people's everyday lives. Lay knowledges frequently offer very different, though equally partial and socio-politically embedded, perspectives on the questions at issue.

Mistrust is also directed towards new forms of governance and private initiative, with citizen perspectives deployed to register protest and boycott, both locally and globally. Yet such reflexive, mobile citizenship is by no means universal, and a major challenge is to understand the diversity of

responses for different people in different settings. Key questions include how, when and among whom reflexivity and protest about globalized economic and technological processes does or does not emerge; the roles of international media and communications in articulating debates across settings, including some and excluding others; and the ways that common social experiences and practices of citizenship may now link groups in the old global north and south.

A range of challenges is suggested. Across different settings, issues and technologies, how do social, cultural and political-economic positions influence the perception and experience of risk? How do certain ideas become embedded as authoritative in governance, while others are marginalized? And how does mistrust develop and become socially-distributed? Such insights will be important to inform thinking about how new, more effective and legitimate partnerships between lay knowledges and expertise, and knowledge production and governance processes might be forged.

Responding to Environmental Change: Flexibility, Resilience and Adaptation

Both technical/natural and social systems are increasingly seen, as discussed above, not in terms of stable, balanced equilibria, but as more dynamic and variable across overlapping temporal and spatial scales. Such a characterization gives rise to issues of path dependency, the potential for rapid transitions between states, and the significance of chaotic elements. This is true both of work on industrial technology in the north, as it is of pastoral, forest or flood ecology in the south.

If uncertainty, variety, surprise and, sometimes, chaos characterize the evolution of complex natural and social systems more often than equilibrium and stability, then conventional planning and policy frameworks become increasingly problematic. A focus on learning, flexibility and adaptation seems more appropriate, and suggests an important way of recasting our thinking about policy and planning approaches, both for local and global issues. This has major implications for the organization and training of professional expertise, and for bureaucratic and administrative procedures and regulatory frameworks, to name but a few.

For social science there are also important new challenges. In particular, there is a need for more integrative approaches to analysis, spanning the social and natural sciences; more exploratory and interactive methods of foresight; a deeper understanding of the attributes and conditions of adaptive capacity and resilience at different levels of social and economic systems; and questions of how principles like equity, precaution, reversibility and regime shifts can be infused into the normative appeal of sustainability.

Reconfigured Boundaries, New Patterns of Authority: Emerging Perspectives on Environmental Governance

As discussed above, the old categories and boundaries between the state, civil society and international organizations are being reshaped in the face of growing global political and economic complexity. New forms of permeability and interconnection are evident. In many places, the authority of nation states themselves is being reconfigured. Powerful alliances are emerging between certain state organizations, transnational corporations, and other international business and political players, with power and profit sometimes sustained through corruption and war. As already discussed, new forms of global governance and institution are emerging, yet are frequently dominated by powerful countries and their agendas. Locally, multiple initiatives and forms of decentralization – connected to different donor, government, private and globally-led initiatives – frequently overlap and conflict, generating further uncertainties. A better understanding of these shifting patterns and their effects is urgently needed to inform the generation of effective forms of multi-level governance.

Political, economic and cultural globalization is generating both new notions of ‘global citizenship’, and resurgences of particularistic identity claims, whether based on culture, ethnicity or religion. Old notions of community based on locality and of citizenship based on nationality have been challenged as individuals acquire multiple allegiances based on, for example, cultural claims, occupation, class, gender or experience of marginalization which extend transnationally. We need to ask what these new patterns of identity and authority mean for people’s access and rights to environmental and other resources and their overall sense of well-being. Such understandings will be critical to serious thinking about new forms of social contract which may now be appropriate in ‘negotiating’ environmental change: between global regimes, states and citizens; between public and private; between (newly-defined) ‘community’ members and so on. Expectations about who delivers what to whom, who is accountable to whom and who represents whom are being reshaped. A key challenge for environmental social science is to reconcile the emergent politics of difference and diversity with older questions around social justice and redistribution.

CONCLUSION

In today’s dynamic, more expectant world, old boundaries and distinctions are being compressed and stretched in new directions. The reconfigurations and complex, unpredictable processes that emerge pose fundamental challenges to

conventional policy models espoused under the banner of sustainable development. The question is what an alternative to the mainstream sustainable development agenda might look like. While there are hints and possibilities in the three themes we have outlined – in notions of knowledge partnership, multi-level governance, local adaptation and flexibility, transnational community, reflexive citizenship and new forms of social contract, for instance – we need a far better understanding of these problems as they play out in different contexts. Such an understanding will require forms of analysis which continue the tradition of cross-disciplinarity and policy engagement that has characterized environmental social science in the last decade. If this often highly productive work can be sustained, environmental social science will continue to provide theoretical and practical policy insights of wide relevance, way beyond the territory conventionally demarcated as environmental.

REFERENCES

- Adam, B., U. Beck and J. Van Loon (2000), *The Risk Society and Beyond: Critical Issues for Social Theory*, London, Thousand Oaks and New Delhi: Sage Publications.
- Adger, N., M. Kelly, and Huu Ninh Nguyen (eds) (2001), *Living with Environmental Change: Social Vulnerability, Adaptation and Resilience in Vietnam*, London: Routledge.
- Agarwal, A. and S. Narain (1991), *Global Warming in an Unequal World: a Case of Environmental Colonialism*, New Delhi: Centre for Science and Environment.
- Agrawal, A. (1995), 'Dismantling the divide between indigenous and scientific knowledge', *Development and Change*, 26, 413–39.
- Anderson, D. and W. Cavendish (1999), *Dynamic Simulation and Environmental Policy Analysis: Beyond Comparative Statics and the Environmental Kuznets Curve*, London: T.H. Huxley School, Imperial College, p. 35.
- Bateman, I.J. and K.G. Willis (eds) (1999), *Valuing Environmental Preferences: Theory and Practice of the Contingent Valuation Method in the US, EU and Developing Countries*, Oxford: Oxford University Press.
- Beck, U. (1992), *Risk Society: Towards a New Modernity*, London: Sage.
- Beck, U. (1995), *Ecological Politics in an Age of Risk*, Cambridge: Polity.
- Benton, T. and M. Redclift (eds) (1994), *Social Theory and Global Environmental Change*, London: Routledge.
- Berkes, F. and C. Folke (eds) (1998), *Linking Social and Ecological Systems. Management Practices and Social Mechanisms for Building Resilience*, Cambridge: Cambridge University Press.
- Berkhout, F. and J. Hertin (2002), *Towards a Political Economy of Corporate Social Responsibility*, June, Goteborg, Greening of Industry Conference.
- Berkhout, F. and R. Howes (1997), 'The adoption of life-cycle approaches by industry: patterns and impacts', *Resources, Recycling and Conservation*, 20, 71–94.
- Blaikie, P. and H. Brookfield (1987), *Land Degradation and Society*, London: Routledge.

- Boehmer-Christiansen, S. (1994), 'Global climate protection policy: the limits of scientific advice', *Global Environmental Change*, 4 (2), 140-159.
- Bryant, R. (1992), 'Political ecology', *Political Geography*, 11, 12-36.
- Costanza R., L. Wainger, C. Folker and K.-G. Mäler (1993), 'Modelling complex ecological economic systems', *BioScience*, 43, 545-55.
- Daly, H. (1994), 'Operationalising sustainable development by investing in natural capital', in A.-M. Jansson, M. Hammer, C. Folke and R. Costanza, *Investing in Natural Capital: The Ecological Economics Approach to Sustainability*, Washington, DC: Island Press, pp. 22-37.
- de Groot, R.S. (1992), *Functions of Nature*, Amsterdam: Wolters-Noordhoff.
- de Simone, L.B. and F. Popoff (1997), *Eco-efficiency: the Business Link to Sustainable Development*, Cambridge, MA: MIT Press.
- Dobson, A. (1990), *Green Political Thought*, London: Routledge.
- Durning, A. (1989), 'Poverty and the environment: reversing the downward spiral', *Worldwatch Paper* 92, Washington, DC: Worldwatch Institute.
- Fairhead, J. and M. Leach (1996), *Misreading the African Landscape: Society and Ecology in a Forest-Savanna Mosaic*, Cambridge: Cambridge University Press.
- Fairhead, J. and M. Leach (1998), *Reframing Deforestation. Global Analysis and Local Realities: Studies in West Africa*, London: Routledge.
- Fineman, S. (ed.) (2000), *The Business of Greening*, London: Routledge.
- GECP (1999), *The Politics of GM Food: Risk, Science and Public Trust*, ESRC Global Environmental Change Programme Special Briefing No. 5.
- GECP (2000a), *Risky Choices, Soft Disasters. Environmental Decision-Making Under Uncertainty*, University of Sussex: ESRC Global Environmental Change Programme.
- GECP (2000b), *Who Governs the Global Environment?*, University of Sussex: ESRC Global Environmental Change Programme.
- GECP (2000c), *Producing Greener, Consuming Smarter*, University of Sussex: ESRC Global Environmental Change Programme.
- GECP (2001a), *Innovation and the Environment: Challenges and Policy Options for the UK*, London: ESRC Global Environmental Change Programme, Imperial College and Fabian Society, p. 25.
- GECP (2001b), 'Environmental justice. Rights and means to a healthy environment for all', in C. Stephens, S. Bullock and A. Scott (eds), *ESRC Global Environmental Change Programme, Special Briefing*, 7.
- Giddens, A. (1991), *Modernity and Self-identity: Self and Society in the Late Modern Age*, London: Polity.
- Grossman, G.M. and A.B. Kreuger (1995), 'Economic Growth and the Environment', *Quarterly Journal of Economics*, 110, 353-78.
- Grove-White R. (1993), 'Environmentalism: a new moral discourse for technological society?', in K. Milton (ed.), *Environmentalism: A New Moral Discourse for Technological Society?*, London/New York: Routledge.
- Grove-White, R., P. Macnaghten and B. Wynne (2000), *Wising Up: The Public and New Technologies*, Lancaster: Lancaster University.
- Gunningham, N. and P. Gabrosky (1998), *Smart Regulation: Designing Environmental Policy*, Oxford: Clarendon Press.
- Gupta, J. (1995), 'The GEF in North-South context', *Environmental Politics*, 4 (1), 19-43.
- Hajer, M.A. (1995), *The Politics of Environmental Discourse: Ecological Modernization and the Policy Process*, Oxford/New York: Oxford University Press.

- Hanley, N. and C.L. Spash (1993), *Cost Benefit Analysis and the Environment*, Aldershot: Edward Elgar.
- Hawken, P., A. and H.L. Lovins (1999), *Natural Capitalism: Creating the New Industrial Revolution*, London: Earthscan.
- Hockenstein, J.B., R.N. Stavins and B.W. Whitehead (1997), 'Crafting the next generation of market-based environmental tools', *Environment*, 39 (4), 12-18.
- Howes, R., J.S. Skea and R. Whelan (1997), *Clean and Competitive: Motivating Environmental Performance in Industry*, London: Earthscan.
- Intergovernmental Panel on Climate Change (2001), IPCC Third Assessment Report WG II: Climate change 2001: Impacts, adaptation and vulnerability, Geneva: IPCC.
- Irwin, A. (1995), *Citizen Science: A Study of People, Expertise and Sustainable Development*, London: Routledge.
- Jacobs, M. (1994), 'The limits of neo-classicism: towards an institutional environmental economics', in M. Redclift and E. Benton (eds), *Social Theory and the Global Environment*, London: Routledge, pp. 67-91.
- Jamison, A. (1996), 'The shaping of the global environmental agenda: the role of NGOs', in S. Lash, B. Szerszynski and B. Wynne (eds), *Risk, Environment and Modernity: Towards a New Ecology*, London: Sage, pp. 224-45.
- Jänicke, M. (1990), *State Failure: The Impotence of Politics in Industrial Society*, Cambridge: Polity Press.
- Jänicke, M., H. Mönch, T. Ranneberg and U.E. Simonis (1989), 'Structural change and environmental impact: empirical evidence on thirty-one countries in East and West', *Environmental Monitoring and Assessment*, 12 (2), 99-114.
- Jasanoff, S. and B. Wynne (1997), 'Science and decision-making', in S. Rayner and E. Malone (eds), 'Human choice and climate change: an international assessment', *The Societal Framework of Climate Change*, 1, Columbus, Ohio: Battelle Press.
- Keeley, J. and I. Scoones (1999), 'Understanding environmental policy processes: a review', *IDS Working Paper*, 89, June, Brighton: IDS.
- Kemp, R., J. Schot and R. Hoogma (1998), 'Regime shifts to sustainability through processes of niche formation: the approach of strategic niche management', *Technology Analysis and Strategic Management*, 10 (2), 175-95.
- Leach, M. and R. Mearns (eds) (1996), *The Lie of the Land: Challenging Received Wisdom on the African Environment*, London: James Currey.
- Leach, M., R. Mearns and I. Scoones (1999), 'Environmental entitlements: dynamics and institutions in community-based natural resource management', *World Development*, 27 (2), 225-47.
- Levy, M.A., P.M. Haas and R.O. Keohane (1992), 'Institutions for the Earth - Promoting International Environmental Protection', *Environment*, 34 (4), 12.
- Markandya, A. and J. Richardson (1992), *The Earthscan Reader in Environmental Economics*, London: Earthscan.
- Mehta, L., M. Leach and I. Scoones (eds) (2001), 'Environmental governance in an uncertain world', *IDS Bulletin*, 32 (4), Brighton: IDS.
- Miller, D. (1995), 'Consumption and commodities', *Annual Review of Anthropology*, 24, 141-61.
- Mol, A.P.J. and G. Spaargaren (2000), 'Ecological modernisation theory in debate: a review', *Environmental Politics*, 9 (1), 17-49.
- Murdoch, J. and J. Clark (1994), 'Sustainable knowledge', *Geoforum*, 25, 115-32.
- Newell, P. (2000), *Climate for Change: Non-State Actors and the Global Politics of the Greenhouse*, Cambridge: Cambridge University Press.

- Pearce, D., W. and R.K. Turner (1990), *Economics of Natural Resources and the Environment*, Baltimore: Johns Hopkins University Press.
- Peet, R. and M. Watts (eds) (1996), *Liberation Ecologies: Environment, Development, Social Movements*, London: Routledge.
- Princen, T. and M. Finger (1994), *Environmental NGOs in World Politics*, Routledge: London.
- Redclift, M. (1984), *Development and the Environmental Crisis: Red or Green Alternatives?*, London: Methuen.
- Redclift, M. (1987), *Sustainable Development: Exploring the Contradictions*, London: Methuen.
- Repetto, R. and M. Gillis (eds) (1988), *Public Policies and the Misuse of Forest Resources*, New York: Cambridge University Press.
- Richards, P. (1985), *Indigenous Agricultural Revolution: Ecology and Food Production in West Africa*, London: Hutchinson.
- Roome, N. (1992), 'Developing environmental management strategies', *Business Strategy and the Environment*, 1 (1), 11–24.
- Scoones, I. (1998), 'Sustainable rural livelihoods: a framework for analysis', *IDS Working Paper*, No. 72, Brighton: IDS.
- Scoones, I. (1999), 'New ecology and the social science: what prospects for a fruitful engagement', *Annual Review of Anthropology*, 28, 479–507.
- Scoones, I. (ed.) (2001), *Dynamics and Diversity: Soil Fertility and Farming Livelihoods in Africa*, London: Earthscan.
- Scoones, I. and J. Thompson (ed.) (1994), *Beyond Farmer First: Rural People's Knowledge, Agricultural Research and Extension Practice*, London: Intermediate Technology Publications.
- Shackley, S. and B. Wynne (1995), 'Global climate change: the mutual construction of an emergent science-policy domain', *Science and Public Policy*, 22.
- Sillitoe, P. (1998), 'It's all in the mound: fertility management under stationary shifting cultivation in the Papua New Guinea Highlands', *Mountain Research and Development*, 18 (2), 123–34.
- Skea, J. (1995), 'Environmental technology', in H. Folmer, H.L. Gabel and H. Opschoor, *Principles of Environmental and Resource Economics*, Aldershot: Edward Elgar.
- Smith, A. and S. Sorrell (2001), 'Interaction between environmental policy instruments: carbon emissions trading and Integrated Pollution Prevention and Control', *International Journal of Environment and Pollution*, 15 (1), 22–41.
- Spaargaren, G., A. Mol and F. Buttel (eds) (2000), 'Environment and Global Modernity', London: Sage.
- Stirling, A. (1998), 'Risk at a turning point?', *Journal of Risk Research*, 2 (1), 97–109.
- Szszszynski, B. (1996), 'On knowing what to do: environmentalism and the modern problematic', in S. Lash, B. Szszszynski and B. Wynne (eds), *Risk, Environment and Modernity. Towards a New Ecology*, London: Sage, pp. 104–38.
- Taylor, P. and F. Buttel (1992), 'How do we know we have global environmental problems? Science and the globalization of environmental discourse', *Geoforum*, 23, 405–16.
- Tiffen, M., M. Mortimore and F. Gichuki (1994), *More People, Less Erosion: Environmental Recovery in Kenya*, Chichester: John Wiley and Sons.
- UNFPA (1991), *Population and Environment: The Challenges Ahead*, New York: United Nations Population Fund.

- Vogler, J. (2001), 'Climate change and American foreign policy', *International Affairs*, 77 (3), 759–60.
- Vogler, J. and M. Imber (eds) (1996), *The Environment and International Relations*, London: Routledge.
- Wapner, P. (1996), *Environmental Activism and World Civic Politics*, Albany NY: State University of NY Press.
- Warde, A. (1990), 'Introduction to the sociology of consumption', *Sociology*, 24, 1–4.
- Warde, A. (1999), 'Consumption and the problem of variety: cultural omniverousness, social distinction and dining out', *Sociology*, 33 (1), 105–27.
- Warren, D.M., L.J. Slikkerveer and D. Brokensha (eds) (1995), *The Cultural Dimension of Development: Indigenous Knowledge Systems*, London: IT Publications.
- Weale, A. (1992), *The New Politics of Pollution*, Manchester and New York: Manchester University Press.
- Welford, R. (1998), *Corporate Environmental Management 1*, Sterling VA: Stylus Publishing LLC.
- Wynne, B. (1992), 'Uncertainty and environmental learning: reconceiving science and policy in the preventive paradigm', *Global. Environmental. Change*, June, 111–27.
- Wynne, B. (1996), 'May the sheep safely graze? A reflexive view of the expert–lay knowledge divide', in S. Lash, B. Szerszynski and B. Wynne (eds), *Risk, Environment and Modernity: Towards a New Ecology*, London: Sage, pp. 44–83.
- Yearley, S. (1995), 'Sociology, Environmentalism, Globalisation', London: Sage.