



Climate change knowledge and social movement theory

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This article discusses climate change knowledge from the perspective of social movement theory, a relatively neglected topic in the literature on climate change knowledge. This article reviews relevant studies and theories of social movements with special attention to the role of knowledge-making in social movements, before tracing the relations between social movements and climate change knowledge from the 1970s to the present. Climate change first emerged as an issue of public concern within the context of the environmental movements of the 1970s and 1980s, while skepticism was shaped, in significant ways, by the neo-conservative and neo-nationalist movements that grew to political significance in the 1980s and 1990s. The neo-liberal movements of the 1990s and 2000s have helped shape the recent rise to public attention of climate change as an overarching political problem. Finally, this article discusses how concerns with 'climate justice' have emerged as part of a social movement for global justice, and concludes by contrasting the different social movements that have affected and influenced the making of climate change knowledge. © 2010 John Wiley & Sons, Ltd. *WIREs Clim Change* 2010 1 811–823 DOI: 10.1002/wcc.88

INTRODUCTION

In all the voluminous commentary that accompanied the failure to reach an international agreement on climate change in 2009, the connections between social movements and those who took part in the formal negotiation process or in the broader public debate have tended to be neglected. And yet, both the negotiations and the public debate about climate change have been significantly shaped by social movements.

It was in the environmental movements of the 1970s that the idea that human activity could be changing the Earth's climatic conditions first left the circumscribed confines of academic discussion to enter into the broader realms of society and politics. The environmental movements provided a social context, a cultural space for biochemists, ecologists and other natural scientists, and engineers to educate the public about environmental issues. Moreover, as part of that process of public education, the scientific conjecture that the accumulation of carbon dioxide and other gases in the atmosphere could, as in a

greenhouse, raise the temperature of the Earth and literally warm the globe started to become public knowledge.^{1–3}

Today, climate change knowledge is a field of contention, with fundamental disagreements over the causes and the appropriate ways to deal with it (for a recent overview of the debate, refer Ref 4, and for a discussion of the reasons for the disagreements, refer Ref 5). While there are a great many different viewpoints, it can be suggested that there are three main positions in relation to climate change knowledge, which will be characterized here as dominant, oppositional, and emergent.

The dominant position is associated with those who have been most active in raising political awareness about climate change in the past decade, and who have promoted a substantial lowering of the emissions of carbon dioxide into the atmosphere and a transition to what has been termed a 'low-carbon society'. The oppositional position is associated with self-proclaimed 'skeptics' who, for various reasons, question the importance of dealing with climate change as opposed to other issues. They have actively challenged the dominant position, primarily by questioning the truth value of the scientific knowledge claims that have been made on its behalf. The emergent position is associated with those who are convinced

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that climate change is occurring, and that it will have serious consequences if it is not abated, but who stress the importance of dealing with climate change in ways that take issues of justice and fairness seriously into account. The positions are neither mutually exclusive nor all-encompassing, but as ideal-typical categories, they can be helpful for exploring the connections between social movements and climate change knowledge.

It is the contention of this article that these three contending positions have been shaped by social movements, especially in regard to their conceptions of science. The neo-conservative and neo-nationalist movements that emerged in the 1970s and grew to political significance in the 1980s, not only in the United States but also in many European countries, have had a major influence on the development of the skeptical or oppositional position, both in relation to climate change, in particular, and environmental issues in general.^{6–9} In these movements, adherence to conservative values or beliefs, including a traditional, discipline-based conception of scientific knowledge, has encouraged rejection of the findings of the climate scientists, who, together with their political spokespersons, such as Al Gore, have been of such central importance in making climate change an issue of public debate during the past two decades.

Many of the most vocal actors in climate change debates, particularly Al Gore, can be considered to have close connections with the rise of neo-liberal or 'transnational capitalist' movements that grew into significant forces in the global political economy after the fall of the Soviet empire in 1989.¹⁰ These movements have been especially important in promoting the establishment of closer relationships between academic scientists and business firms, and in commercializing scientific knowledge. This has happened throughout the world but in a particularly strong manner in the United States, where the process of 'academic capitalism' has been most pronounced.^{11,12} The conception of science that is shared by most of the vocal actors in climate change politics is non-disciplinary and entrepreneurial in that the knowledge that is made in many climate research centers and panels is dependent on the contexts, both financial and organizational.^{13–16}

In recent years, it has been the so-called anti-globalization movement that has provided the social context for concerns with 'climate justice' to be articulated as a third mode of climate change knowledge.^{17,18} Like the anti-globalization movement as a whole, however, the proponents of climate justice are yet to articulate a coherent sense of collective identity or common purpose, and that is why this

position in relation to climate change knowledge is best characterized as emergent.

These relations between social movements and climate change knowledge have not received much attention either in the academic or more popular literature. Those who write about social movements tend to define and analyze them primarily in political and organizational terms, while those who write about climate change knowledge tend to relegate social movements to the contextual background, focusing most of their attention on the specific discourses, deliberations, and cognitive claims of actors and institutions concerned with climate change. As such, an understanding of the social movements that have served to help shape climate change knowledge has been neglected. While we all know intuitively that there are connections between broader political and social movements and climate change knowledge, the links are seldom explicit focuses in the scholarly and popular literature.

By reviewing the history of climate change knowledge from the perspective of social movements and social movement theory, and thus bringing, as it were, the contextual background into the textual foreground, this article attempts to help fill this gap in understanding.

WHAT IS A SOCIAL MOVEMENT?

There is little agreement among those who study social movements about what a social movement 'really' is. Definitions depend on which movements are seen as typical or most important, what kind of terminology or conceptual framework is applied, the particular research questions being addressed and, not least, the situation or standpoint of the researcher.^{19,20} Since Neil Smelser²¹ in his classic work, *Theory of Collective Behavior*, divided movements into those who are variously 'results-oriented' and 'values-oriented,' there has been a bifurcation among the students of social movements; namely, between those who focus on what might be termed movements in the streets versus those who focus on movements in the mind. Even so, for all their differences, the various definitions that have been most actively applied in the scholarly literature can be said to share certain common features or elements which will be used to provide a 'working definition' of social movements for the purposes of this article.

On one hand, a social movement will be defined here as a collective form of social behavior that is explicitly organized for political action. A social movement is the process by which human and material resources are mobilized in trying to affect political change (an influential recent discussion is Ref

22). In pursuit of one or another political cause, they make use of what Herbert Kitschelt²³ termed ‘political opportunity structures’ in his analysis of anti-nuclear movements in the 1970s. Social movements tend to manifest themselves through publicly recognized forms of protest or direct action, but these acts do not themselves make a social movement. They need to be linked or connected to one another in some way, organized, and coordinated by means of a common platform or program. This provides what has been termed a ‘collective identity’, a set of values or precepts or beliefs that empower those who share and identify with them. These matters of collective identity formation have been most influentially theorized and studied by Alain Touraine and Alberto Melucci and their students and colleagues (refer Refs 24–27).

On the other hand, a social movement is something distinct from more formalized political parties, social institutions or other established kinds of politics in that it ‘moves’ or, put another way, has a more informal character than established political and social activities; in this regard, social movements resemble what Ulrich Beck²⁸ termed ‘subpolitics’. Many theorists have attempted to distinguish movements from institutions and movements from organizations and political parties (perhaps most famously Alberoni 1984),²⁹ and a recurrent theme in social movement studies has been to analyze processes of institutionalization and professionalization. In recent years, social movements have come to be ever more likened to, and conceptualized as, networks. They have come to be seen as central to what Manuel Castells has termed the ‘network society’,³⁰ with attention given to distinguishing between the different kinds of networking, brokerage and (inter)mediation that goes on in social movements.³¹ In many contemporary social movements, not least those related to climate change, much of this networking activity is now conducted ‘virtually’ via electronic communication and the Internet.³²

A third element of almost all theories of social movements is the understanding that they are more than ‘merely’ political phenomena and that they involve some form of what Jurgen Habermas^{33,34} so influentially has termed communicative action. As in other fields of social science, there has been an increasing interest in these more communicative or cultural aspects of social movements, even though there is little agreement about how best to study or theorize them (cf. Refs 35 and 36). Many social movement analysts use the concept of framing to discuss these matters^{37,38} while others emphasize the role of passions and emotions (cf. Ref 39). Other theorists, usually within anthropology, have focused explicit attention on the uses of knowledge by social

movements, perhaps most influentially the uses of so-called indigenous knowledge by social movements in non-Western countries.^{40,41}

The cognitive approach to social movements¹⁹ makes use of the terms ‘cognitive praxis’ and ‘movement intellectuals’ to emphasize the role of knowledge-making in social movements and to characterize the people who are most actively involved. Cognitive praxis is defined as the linking or integration of ideas, ideologies, and/or world view assumptions (a cosmological dimension) to particular activities or forms of action, including technical development, information dissemination, and practical demonstration of both protest and constructive alternative (a technological dimension). The movement is seen as providing an organizational dimension and a public space for integrating the cosmology and the technology in processes of collective learning, and their cognitive praxis makes social movements particularly important in the constitution and reconstitution of science and technology.^{42,43} Eyerman and Jamison⁴⁴ broaden the cognitive approach to encompass cultural practices and, by so doing, focus attention on the role that the ‘mobilization of tradition’ plays in the collective activities of many social movements. It is the mobilization and (re)invention of different traditions of ideas, beliefs, and ideologies that often plays an important role in attracting active participation and involvement in social movements.

For the purposes of this article, social movements will thus be defined as processes of political protest that mobilize human, material, and cultural resources in networks linking individual actors and organizations together in pursuit of a common cause. They provide spaces in the broader culture for new forms of knowledge-making and socio-cultural learning as a central part of their activity.

THE EMERGENCE OF CLIMATE CHANGE KNOWLEDGE

Climate change was first identified as a potentially significant public concern as one of the many aspects of an ‘environmental crisis’ that was to lead to the emergence of environmental movements in the 1970s. Like the other social movements that grew out of the student revolts of the 1960s—those of women’s liberation and anti-imperialism, in particular—the environmental movements, as they started to be called in the 1970s, were highly critical of the ways in which knowledge was produced in society, and the ways in which students were educated. Most of the active members were University and high-school students, and most of the activity was a collective learning in

relation to environmental problems and dealing with what came to be termed ‘the environmental crisis’.^{45,46}

The cognitive praxis of the environmental movements was based on a philosophy or cosmology of systemic holism derived from systems theory and popularized in such books as *Barry Commoner's The Closing Circle (1971)*, *A Blueprint for Survival*,³ *Only One Earth*,² as well as in the influential writings of the American ecosystem ecologists, Eugene and Howard Odum.⁴⁷ In the environmental movements, this ecological philosophy or worldview was combined with a practical interest in appropriate, small-scale technology that was popularized in such books as *Tools for Conviviality* by Ivan Illich⁴⁸ and *Alternative Technology and the Politics of Technical Change* by David Dickson⁴⁹ and practiced in new movement settings or spaces such as the Center for Alternative Technology in Wales, the New Alchemy Institute in the United States, and a wide range of production collectives and alternative communities.⁵⁰

It was within the cognitive praxis or knowledge-making activity, of the environmental movements of the 1960s and 1970s that climate change was first identified as a potentially significant social and political problem. In *Barry Commoner's The Closing Circle*, for instance, before the ‘four laws’ of ecology are presented as a new political philosophy or program, the reader is introduced to the crucially important role that carbon dioxide emissions play in the so-called greenhouse effect:

Carbon dioxide has a special effect because it is transparent to most of the sun's radiation except that in the infrared region of the spectrum. In this respect, carbon dioxide is like glass, which readily transmits visible light, but reflects infrared. This is what makes glass so useful in a greenhouse in the winter. Visible energy enters through the glass, is absorbed by the soil in the greenhouse, and then is converted to heat, which is reradiated from the soil as infrared energy. But this infrared energy, reaching the greenhouse glass, is bounced back and held within the greenhouse as heat. . . . Like glass, the carbon dioxide in the air that blankets the earth acts like a giant energy valve. Visible solar energy easily passes through it; reaching the earth, much of this energy is converted to heat, but the resultant infrared radiation is kept within the earth's air blanket by the heat reflection due to carbon dioxide. Thus, the higher the carbon dioxide concentration in the air, the larger the proportion of solar radiation that is retained by the earth as heat (Commoner,¹ pp. 26–27).

Commoner's four laws of ecology—‘everything is connected to everything else’, ‘everything must go somewhere’, ‘nature knows best’, and ‘there is no such

thing as a free lunch’—provided a set of cosmological or worldview assumptions for the environmental movements that, in the course of the 1970s, became significant political actors in several northwestern European countries, as well as in North America. In political campaigns directed against various kinds of air and water pollution, chemicals in food and agriculture, and especially against the development of nuclear energy, environmental movement organizations, together with students and teachers at universities, learned about environmental problems.^{46,51,52}

They also learned about alternative, ‘environmentally friendly’ ways to produce energy, food, and other necessities of life, that were based on an ecological worldview. Activists and academics joined together to learn how to build solar energy panels and wind energy plants, grow organic food, and to try to live more ecologically—what we today would call climate-smart; i.e., finding ways to develop technology that do not emit carbon dioxide and other greenhouse gases (for a contemporary overview, refer Ref 53). In the Netherlands, ‘science shops’ were established at several universities to provide points of mediation between the academic world and the broader society, and in many other countries the environmental movements fostered other forms of ‘citizen science’.⁵⁴ The environmental and energy movements of the 1970s also inspired the formulation of new ideas about science and technology, both for the production of energy but also more generally.^{55–58}

In Denmark, local groups in the national Organization for Renewable Energy arranged courses at many folk high schools and created centers for renewable energy, such as the Nordic center in Thisted, which is still in operation. In 1978, the world's then largest wind energy power plant was constructed by students at the Tvind folk high schools on the Danish west coast, not far from where VESTAS, the world's largest wind energy company, is now based.⁵² Mobilizing a Danish tradition—Poul La Cour, a folk high school physics teacher in the 19th century had been one of the first in the world to experiment systematically with wind-power generated electricity production—the Organization for Renewable Energy (or OVE, *Organisation for Vedvarerende Energi*) has continued to foster ‘grassroots innovation’ ever since. Of course, the Danish interest in wind energy was also motivated by economic concerns and, not least, by the widely felt need at the time to diminish national dependence on foreign oil, but the mobilization of an indigenous engineering tradition was important in providing valuable cognitive and cultural resources for the subsequent development of wind energy.⁵⁹

THE SHAPING OF CLIMATE CHANGE SKEPTICISM

As the political climate in North America and north-western Europe turned to the right in the 1980s, environmental politics changed character, and the making of environmental knowledge changed as well. From a social movement perspective, this right turn in politics represented a mobilization of conservative traditions or—as they are often referred to in the United States—neo-conservative values and interests. Religious and nationalist concerns were fundamental to these neo-conservative movements which emerged, at least in part, as a kind of organized opposition to the environmental and women's movements of the 1970s and the kind of knowledge they had embodied and articulated.^{6,60–62}

In many European countries, similar movements emerged at this time to oppose immigration and European integration. In Denmark, there was a strong mobilization against entrance into the European Union, and this later led to the building of the Danish People's Party which, in many ways, retains the character of a social movement even though it has become an established political party. Neo-nationalism in Europe resembles neo-conservatism in the United States, both in terms of an adherence to what might be termed a populist conception of knowledge, as well as in regard to a cosmological belief in national identity and the importance of upholding traditional values.

It is beyond the scope of this article to discuss these movements in any detail. However, like other social movements, they can be said to have mobilized human, material, and cultural resources for purposes of political protest. As with many other recent movements, they have organized themselves through various social networks that provide opportunities for interested individuals to interact. Networks in the mass media, radio, and television, as well as in other settings, such as political action committees in the United States, have provided what can be termed the organizational dimension of these movements' cognitive praxis. Most recently, these networks have been strengthened by the Internet and various other forms of electronic communication, but even before the Internet became widely used, a number of new think tanks and study organizations developed in both Europe and the United States to spread the ideas of neo-conservatism and neo-nationalism.^{8,62} As such, the neo-conservative cosmology was linked to specific actions (to protest, among other things, abortion rights in the United States, and immigrant rights in Europe).

It was within the socio-cultural space carved out by these neo-conservative and neo-nationalist

movements that anti-environmentalism would emerge as a political force in the course of the 1980s. Already in the debates about nuclear energy in the 1970s, a number of natural scientists, especially atomic physicists, began to challenge the forms of knowledge-making and the epistemic claims that were promulgated in the new social movements of the 1970s, particularly in the environmental and anti-nuclear movements. Indeed, the energy debates of the 1970s were, in large measure, debates about different conceptions of science and technology. Out of those debates would later grow a defensive attitude toward what might be termed traditional science on the part of many scientists, and, more specifically, an opposition to the scientific methods and modeling techniques that would become so important in the making of climate change knowledge, in particular the complex general circulation models.^{63,64} While certainly not all climate change skeptics are neo-conservatives or neo-nationalists—many skeptics are simply dubious about the kind of scientific claims that are made—it was the neo-conservative movement that provided a context for climate change skepticism to become politically significant.

Denmark is an interesting example in this regard. Bjorn Lomborg's⁶⁵ rise to national and, later, international prominence corresponds in time to the rise in political significance of neo-nationalist movements in Denmark and its political wing, the Danish People's Party.⁹ While disagreeing on many substantive issues, Lomborg and the Danish People's Party share a common opposition to the strong emphasis that was given to 'green' politics in Denmark in the 1990s and, in terms of their cognitive praxis, they share what might be termed a traditional conception of scientific knowledge.

THE RISE OF GREEN BUSINESS

At the same time as the anti-environmental 'backlash' was taking shape in the 1980s, the environmental movement itself fragmented into a number of different organizations and institutions, both in terms of politics and knowledge-making.^{46,51} Green parties were formed in many countries and professional activist organizations, such as Greenpeace, grew in significance, while more broad-based grassroots organizations that led the campaigns against nuclear energy in the 1970s tended to weaken.⁶⁶ Within universities and new environmental 'think tanks' such as the World Resources Institute and the Wuppertal Institute, different sorts of experts started to make more specialized kinds of knowledge in areas such as renewable energy, organic agriculture and, eventually, in relation to climate change.⁶⁷

As such, more professional and established forms of knowledge-making started to replace the kinds of appropriate or alternative science and technology that had been so prominent in the 1970s. Many of those who had been active in the environmental movements in the 1970s left the movement behind to make careers in universities, as well as in the wider worlds of government, media, and business. As the surrounding society became more commercial and competitive in the course of the 1990s—the result, one might say, of another social movement, namely that of globalization or neo-liberalism—a good deal of green knowledge also became more commercial and competitive. Instead of learning together and cooperating with each other in projects of collective learning, many makers of green knowledge went into business.^{68–70}

Especially in the United States but also in many European countries, universities were encouraged to form closer ties with private companies. At first, in the 1980s, the links were primarily institutional, as offices for technology transfer and product development were established at many universities and science parks allowing companies to locate near University campuses became ubiquitous. In the course of the 1990s, a broader process of commercialization of science took place as new neo-liberal think tanks and a range of research institutes started to proliferate outside the universities, often funded by private companies.^{11,12,71}

These forms of knowledge-making were supported and encouraged by new market-oriented approaches to science, technology, and environmental policy that became especially important in several European countries in which social-democratic governments pursued policies of ‘ecological modernization’ in the 1990s, often with the support of green parties. These forms of knowledge-making and new market-oriented approaches to science, technology, and environmental policy also marked the Clinton–Gore administration in the United States.^{72,73} In Germany, Great Britain, Denmark, Sweden, and the Netherlands, as well as at the European Commission, promoters of ecological modernization sought to combine environmental concern with economic growth. As climate change became a more integral part of environmental politics in the 1990s, it was the market-oriented approaches that tended to dominate the international deliberations, both in Kyoto, as well as within intergovernmental administrative and scientific advisory bodies, such as the Intergovernmental Panel on Climate Change (IPCC).

From a social movement perspective, the rise of market-oriented environmentalism—what I have termed ‘green business’⁴⁶—was shaped by the broader neo-liberal movement that Leslie Sklair¹⁰

has characterized in social movement terms as ‘transnational capitalism in action’. Whether we consider neo-liberalism as a social movement or as a political ideology, it has certainly exerted a powerful influence on environmental politics in general and on the politics of climate change, in particular. Much of the knowledge-making activity within green business tends to be organized in commercial networks, with University scientists and engineers working together with companies on specific projects. There are also a number of ‘movement intellectuals’ in the commercial media as well as in private consulting companies who serve to articulate the underlying importance of meeting the climate challenge in commercial terms. Along with Al Gore, the author and *New York Times* columnist, Thomas Friedman, have been perhaps the most publicly visible intellectuals of these movements. The ‘cognitive praxis’ of green business exemplifies the dominant approaches of academic capitalism in the promotion of commercially oriented technological innovation and of green product development as the main ‘solution’ to climate change.

The cosmology of green business is based on a belief in a convergence between economic growth and environmental protection. Depending on the context, it has been termed ecological modernization, eco-efficiency, corporate sustainability or green growth. In the words of Maarten Hajer, central to the political discourse of ecological modernization in the 1990s was ‘the fundamental assumption that economic growth and the resolution of the ecological problems, can in principle, be reconciled. Hence, although some supporters may individually start from moral premises, ecological modernization basically follows a utilitarian logic: at the core of ecological modernization is the idea that pollution prevention pays’ (Ref 68, p.27). In the course of the past 15 years, particularly in China and other Asian countries, this fundamental assumption is central to major national programs in ‘green growth’.

One of the main proponents of market-oriented, green business approaches to addressing climate change has been the former US vice-president Al Gore. Already in his first book, Gore⁷⁴ combined arguments for economic growth with arguments for environmental protection in providing what he called a ‘new common purpose’ for humanity. After the fall of the Soviet empire, the ‘singular will of totalitarianism’ had fallen as a challenge:

But now a new challenge—the threat to the global environment—may wrest control of our destiny away from us. Our response to this challenge must become our new central organizing principle. The

service of this principle is consistent in every way with democracy and free markets (Gore,⁷⁴ p. 277).

In his book, Gore proposed what he then termed a 'Global Marshall Plan' for saving the environment, by which he meant massive investments in renewable energy companies and in other environmentally friendly technological developments. In the 1990s, as vice-President, Gore led the US delegation to Kyoto, where he was one of the central promoters of what has since been termed the cap-and-trade approach for dealing with climate change. After losing the 2000 election, Gore emerged as the main proponent for using market mechanisms and business ventures to respond to what he so famously called the 'inconvenient truth' of climate change.

AN EMERGENT MOVEMENT FOR CLIMATE JUSTICE

In the last few years, a new kind of political activism, often involving forms of civil disobedience and direct action, has emerged in relation to climate change and has led some observers to begin referring to a climate justice movement as a part of a broader movement for global justice.

The global justice movement has been characterized as a 'movement of movements', a term coined by Naomi Klein in the wake of the anti-globalization protests of the late 1990s. The term captures well the heterogeneous character of the emerging submovement for climate justice, as well as the broader global justice movement.⁷⁵ Both the movement and submovement are filled with tensions and contradictions, composed as they are of a variety of groups and individuals who have begun to take political action in order to protest the quite different kinds of negative consequences that they attribute to globalization, and proposing ways of dealing with them in a more equitable and just manner.

For the influential theorists Hardt and Negri,⁷⁶ the working class 'masses' that were mobilized in the social movements of the late 19th and early 20th centuries have given way to a 'multitude' of disenfranchised and disenfranchised global citizens. While a multitude of voices and concerns has begun to be heard in relation to globalization and climate change, the multitude has not yet formed a shared set of beliefs that can serve as a cosmological dimension for a social movement's cognitive praxis. An awareness throughout the world is emerging about the need for a movement for climate justice but, at least for this observer, there is little agreement as to what the movement should do and how it should organize itself.

Like other social movements in their initial stages, there is as yet no real integration of the relatively abstract theorizing about global injustice voiced by theorists like Hardt and Negri with the multifaceted array of practical activities that are being carried out. In other words, there is no social movement with a coherent or integrated cognitive praxis yet.

There are at least three different kinds of submovements or networks concerned with global justice and which take part in various international gatherings that sometimes are said to represent the global justice movement. On one hand, there are the parties, organizations, federations, and other institutionalized legacies of the so-called 'old' social movements of the late 19th and early 20th centuries, the various outgrowths of populist and socialist movements that have become integral parts of the political landscape in both the global North and the global South. Issues of equality and justice for workers and farmers have been central to these movements from the outset and in the contemporary world they tend to base their political activity on socialist values of one denomination or another. In the emerging movement for global justice, members of various socialist organizations and parties often enter into alliances with other kinds of organizations with very different backgrounds and motivations. As a result, it has been difficult to reach an agreement or form a collective identity about particular topics such as climate change.

A second important component of the emerging movement is based on the concerns of the so-called new social movements of the 1970s, especially the movements for environmental protection, anti-imperialism, and women's liberation that were so significant in the United States and northern Europe. These movements have tended to become established fixtures in the contemporary world, primarily in the form of non-governmental organizations (NGOs) that have developed around particular issues and projects. These organizations have developed a more business-like, professional approach to politics; they have largely become institutions rather than movements and, much like University scientists and engineers, have become dependent on external funding for much, if not most, of their activity (cf. Ref 67).

In recent years, these 'old' and 'new' social movements have been complemented by a newer wave consisting of a new generation of activists and of groups and organizations which are often more confrontational than the older movements. These are more directly focused on the negative consequences of globalization, including climate change. Beginning in the 1980s, sometimes in the name of 'environmental justice', these groups have often emerged in direct

opposition to particular examples of global injustice, as in campaigns against the imposition of genetically modified organisms by transnational corporations in developing countries, the construction of large infrastructural projects (dams, airports, and bridges) in both developed and developing countries, and the destruction of rain forests and other biotopes in the name of economic development.^{77–79}

These are, for the most part, campaign organizations that sometimes band together in alliances in order to oppose specific cases of global injustice, but there are also a number of primarily local organizations in both the global North and global South that carry out a range of more constructive activities in relation to such areas as renewable energy, ecological housing and design, and organic agriculture. In recent years, there have been attempts to arrange gatherings, where the different component parts of the global justice movement can meet and discuss their concerns, and exchange their experiences. These various ‘social forums’, as they have come to be called, have taken place both at an international level (at world social forums, that have been held each year since 2000), as well as at more regional, national, and local levels, particularly in Europe.⁸⁰

There are geographical tensions among the various component parts of the emerging global justice movement and, as might be expected, major differences among those actively involved in regard to specific issues like climate change. Climate justice tends to mean something very different for activists in the global North than it does for activists in the global South. The very different life experiences and expectations of the participants make it difficult to develop a common understanding and shared belief system. Ideas of fairness and equity are highly dependent on contexts of history and place. As has been clear throughout the history of international climate change deliberations, there is a fundamental difference between the meaning of ‘climate justice’ for those living in the industrialized and developed countries of the global North and those living in the industrializing and developing countries of the global South (cf. Ref 81).

In addition to this basic geographical conflict, there are also generational and intellectual tensions. On one hand, the attitudes of labor organizations and social-democratic and communist parties tend to be positive toward modern science and technology and toward ‘modernization’ in general. In relation to climate change, technological development is generally seen as a central ingredient of the politics and policy of climate change, most controversially leading to a resurgent support for the development of nuclear energy among many on the left who also purport to

believe in one or another form of ‘climate justice’ (cf. Ref 82). On the other hand, the institutional legacies of the new social movements of the 1970s—primarily the larger environmental NGOs—tend to see climate change exclusively as an environmental challenge and, until quite recently, have tended to disregard the social and political implications of climate change.

The task of alerting the public to the wide range of challenges that climate change raises in regard to global justice and social inequality has fallen primarily to a relatively small group of newer organizations and activists. Particularly in Africa, Asia, and Latin America, groups and alliances to save rainforests, preserve biodiversity, defend the rights of indigenous peoples, and develop sustainable forms of agriculture and industry are rapidly proliferating, and some of them have begun to take part in the international climate change debate.^{18,83,84} In North America and Europe, some of the development-oriented and more radical environmental NGOs, such as OXFAM and Friends of the Earth, have begun to include climate change in their activities as well. In several European climate action campaigns, and internationally through the 350.org campaign started by American writer and environmentalist Bill McKibben, a number of protest actions and climate camps have been carried out in recent years, the most noticeable being perhaps the occupations of airport runways with activists dressed as polar bears. At the Copenhagen COP15 meetings, there were several organized protest actions as well as large street demonstrations, and it is to be expected that such a direct action will continue in the years to come.

There is also a growing, but still relatively small, number of cases of collaboration between academics and activists in universities and local communities in trying to deal with climate change and other environmental problems in just or equitable ways.^{85,86} New forms of community based innovation and knowledge-making can be identified in local food movements around the world, as well as in a range of not-for-profit engineering projects in such areas as sustainable transport, renewable energy, and low-cost, environmentally friendly housing. A project at the School of Architecture and Planning at the University of Texas, in which students and teachers, in cooperation with local housing suppliers and neighborhood groups in East Austin, Texas, have designed low-cost, climate-smart housing shows what can be done ([87, cf. Ref 88]).

Unfortunately, such activities fall well outside of the mainstream and remain quite marginal at universities in most countries, although several universities in the United States have established

programs in engineering for sustainable community development in recent years.⁸⁹ In some of these programs there is institutional outreach of a kind that was characteristic of the bridge-building activities that took place at many universities in the 1970s, but most of them are yet to achieve the influence and legitimacy that would make them significant players in the global politics of climate change. The increasing encroachment of a commercial and entrepreneurial value system at universities makes it difficult for concerns with climate justice to be given the attention they deserve in higher education.

It has proved difficult for such activities to coalesce into what Keck and Sikkink⁹⁰ have termed transnational advocacy networks. The kind of ‘activism beyond borders’ that has been so important in political struggles in many parts of the world has often mobilized forms of local or indigenous knowledge which up to now have not entered into the making of climate change knowledge in a significant way. The failure of the Copenhagen meeting has led to some efforts in this regard, such as the formulation of the ‘people’s agreement of Cochamamba’ in April 2010 at the World People’s Conference on Climate Change and the Rights of Mother Earth, held in Bolivia,⁹¹ and the establishment of climate justice networks in both the global North and the global South. It remains to be seen, however, whether such efforts will be able to play a significant role in the making of climate change knowledge and in establishing meaningful international agreements.

CONCLUSIONS

From a social movement perspective, climate change knowledge can be seen as a field of contention and, as I have attempted to show in this article, the contending positions are connected to broader political and social movements (refer Box 1).

On one hand, there is an oppositional approach to climate change knowledge that is connected to the broader neo-conservative and neo-nationalist movements. In these movements, which developed as a kind of a backlash to the new social movements of the 1970s, there is a traditional conception of science and knowledge as detached, objective truth-seeking. Many older scientists and engineers, among them physicists trained during the 1940s and 1950s when physics enjoyed high prestige in the sciences and broader society, joined together with more reactionary people and outright anti-environmentalists in being skeptical to the scientific claims and policy recommendations of those favoring more ambitious responses to climate change.

| BOX 1 CONTENDING APPROACHES TO CLIMATE CHANGE KNOWLEDGE | | | |
|--|------------------------------|-----------------------------------|-------------------------------|
| | Oppositional ‘skepticism’ | Dominant ‘green business’ | Emergent ‘climate justice’ |
| Broader movement | neo-conservative | neo-liberal | global justice |
| Ideal of science | academic, disciplinary | entrepreneurial, non-disciplinary | engaged, cross-disciplinary |
| Forms of knowledge | traditional, personal | context-dependent, proprietary | ‘hybrid’, public collective |

As noted in the case of Bjorn Lomborg,⁹² self-proclaimed skeptics do not necessarily accept neo-conservative or neo-nationalist positions on all political issues, but when it comes to climate change, there is a widely shared belief in what might be termed the traditional academic norms of science. These were influentially formulated in the 1940s by the American sociologist Robert Merton and they have long been seen by many natural and social scientists, as well as large segments of the general public, as core values in the scientific enterprise.⁹³ The norms of communalism, universalism, disinterestedness and, not least, organized skepticism continue to be seen as defining features of science, even though the practice of science has fundamentally changed since Merton characterized them, largely as a way to help defend science from communism and Nazism. As such, even though many skeptics do not actually ‘practice what they preach’ in their own scientific or political work, they serve as a shared rhetorical resource for the very different kinds of skeptical positions in regard to ambitious efforts to deal with climate change.

The dominant approach to climate change knowledge corresponds to what has been termed the new ‘mode’ of knowledge production¹³ in which the traditional boundaries between science and politics and the borders between the academic and commercial worlds are increasingly transgressed.^{71,94} In these contexts, science is not carried out in a disinterested and impartial fashion. Rather, it is funded by external interests in order to contribute directly to policy-making as well as to technological development. In relation to climate change, such policy relevant research has been extremely important in many climate research centers, as well as in the IPCC.^{15,95–97} Such research is often carried out in networks

connecting academics, government, and business in specific projects, to provide policy advice as well as profitable 'solutions' to climate change. As such, it is based on a different set of epistemic criteria than traditional, academic science, with different methods of investigation, different procedures of interpretation, and different rationales of justification and verification.^{14,16,63,98,99}

At the same time, the entrepreneurial values that have come to replace the traditional academic values of science, even among many self-proclaimed skeptics, has led at least some more traditionally minded scientists to question the truth value of the dominant approach to climate change knowledge.⁶⁴ One particularly notable example of a highly-renowned scientist who has been vocal in his skepticism is physicist Freeman Dyson.¹⁰⁰ The close links to business of at least some of the leading spokespersons for this kind of science, such as Al Gore, have also led to charges of conflict of interest.^{101,102}

A third approach to climate change knowledge, that is explicitly connected to concerns of global justice and fairness, is comparatively weak at the present time, and its future development will depend not so much on transcending disciplines as in cross-fertilizing activist and academic knowledge in developing a change-oriented 'green knowledge'.^{46,103} While a number of good examples have provided sources of inspiration and mobilization in recent years, perhaps especially in relation to food and energy, a commonly shared theoretical and conceptual framework has not yet developed. In a world in which universities have become increasingly market-oriented and in which knowledge has largely been

transformed into a commercial commodity, cross-disciplinary and cross-cultural knowledge making is, to put it mildly, not particularly encouraged, well-supported or understood.

Will the emergent movement for climate justice be able to develop a new approach to knowledge-making that moves beyond the traditional and the commercial approaches? How can ideas of global justice and citizenship be combined with practical experiments in sustainable development so that a process of collective learning might actually take place? What might an integrative cognitive praxis around climate justice actually look like?

Since climate change is such an all-encompassing and multifaceted issue, it will be necessary to foster what I have termed a 'hybrid imagination' mixing natural and social, local and global, academic and activist forms of knowledge in new combinations.^{104,105} In this regard, perhaps the efforts of the physicists-turned-environmentalists, Vandana Shiva and Fritjof Capra can provide inspiring role models. In their writings, both Shiva and Capra have tried through many years to combine disparate fields of science in an engaged and personal way, and have presented their knowledge in popular, accessible form outside the established academic world.^{58,106–110} Both have also created centers for research and education and taken part in a wide range of political campaigns and struggles. Much will depend on how successful 'movement intellectuals' in an emergent movement of climate justice will be in developing public spaces where scientists, engineers, and citizens can come together to learn from each other and bring their different kinds of knowledge into fruitful combinations.

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