This is the pre-publication submitted version of the following paper:

Scott, D. and Barnett, C. (2009). Something in the Air: Civic science and contentious environmental politics in post-apartheid South Africa. *Geoforum* 40, 373-382.

Something in the Air: Civic science and contentious environmental politics in post-apartheid South Africa

Abstract

In post-apartheid South Africa, the emergence of the environmental movement has involved the reframing of the environment as a 'brown' issue connecting to the discourse of social and environmental justice and a rights-based notion of democracy. Environmental movements have pursued a dual strategy of deliberation and activist opposition. Within these processes, movements have used science to pursue the strategic task of democratic opposition and have established networks of environmental knowledge and expertise. This process has been most developed in south Durban due to the history of political struggle and environmental racism. Within the science-based policy approach, the regulation and management of the environment is premised on the need for science, which provides the authoritative basis for a regulatory response. In local environmental movements, there exists a fundamental tension between a cumulative history of lay knowledge about pollution and the lack of official acknowledgement of qualitative narratives accompanied by a lack and suspicion of reliable official data. Environmental movements thus have thus employed 'civic science' strategically to place the issue of air pollution on the political agenda. The paper sets out to use the case of south Durban to reflect on the ways in which scientific knowledge is produced and disseminated to pressure the state and capital. In this case, the three ways in which knowledge is deployed are: in the framing of environmental problems, in strategies of oppositional advocacy, and in deliberative policy forums. The paper reveals that in contexts of entrenched socio-economic inequality, the resources provided by knowledge networks allows movements to engage in a 'politics of shame', which articulates with the legitimacy imperatives of the newly democratized state.

Key Words: science, environment, urban politics, South Africa, environmental movements

Something in the Air: civic science and contentious environmental politics in post-apartheid South Africa

1) Introduction

Since the late 1990s in post-apartheid South Africa, a wide range of social movements have emerged challenging the state around issues of political and socio-economic rights (Bond, 2002; Desai, 2002; McDonald and Pape, 2002; Ballard et al, 2004). The environmental movement is part of this broader oppositional process and has involved the reframing of the environment as a 'brown' issue connecting to the discourse of social and environmental justice and a rights-based notion of democracy (Cock, 2004; Barnett and Scott, 2008, in press). This is in line with the holistic definition of the environment in South African environmental legislation but in contrast to the narrow biophysical interpretation of the environment, dominant in both the practice of environmental management and the historical legacy of 'green' environmental movements.

There has been a growth of environmental movements in the post-1994 period in South Africa although there is no overall coherent structure in this movement (McDonald, 2002; Cock, 2004). The environmental movement in South Africa is however, most developed in south Durban. Here a history of forced removals based on environmentally racist planning led to the development of a core of heavy industry surrounded by low-income black residential areas since the early twentieth century (Scott, 1992; 2003). South Durban has a history of civic struggle through which residential communities and workers fought for a better living environment, housing, jobs and other reproductive needs (Scott, et al, 2002). The South Durban Community Alliance (SDCEA) was established after 1996 and is a post apartheid movement. Building on the historical experiences of political activism in the black communities of south Durban, it has set out to counter the contemporary impacts of industrial expansion by mobilising the communities in south Durban across race and class lines, as well as networking with international organizations and funders (Barnett and Scott, 2007b). In doing so, they have reframed the environment as a people centred or 'brown' issue with the focus of democratic opposition as a critique of state policies of economic growth. The focus on air pollution is emblematic of this larger project. Another strand in this narrative is that the communities hold the state accountable for delivery of basic needs, claiming that a clean, safe and healthy living environment is an environmental right according to the South African Constitution (Klandermans, 2001).

In their oppositional strategies, SDCEA face a context in which the dominant environmental management practices are couched within the discourse of ecological modernization and consequently weak sustainability (Oelofse et al, 2006). Thus, a science based policy approach dominates where scientists and experts lead environmental decision-making processes. Science is thus strategically employed by actors, business or the state, to frame environmental issues and impose particular claims of authority. Policy interventions have to be legitimated by scientific evidence (Hajer,

1995; Fischer, 2003) and therefore oppositional politics needs to be framed within a scientific discourse to be able to present alternative societal options.

Despite the existence of a more democratic and socially just national framework of environmental management embodied in the National Environmental Management Act (NEMA) (Act 107 of 1998), daily environmental management practices remain technocentric and managerialist, resulting in the marginalization of social issues and actors promoting these issues and the devaluation of local knowledge (Michael, 1992: Christoff, 1996; Scott et al 2001; Laros, 2004). Within this context dominated by scientific arguments, SDCEA have more latterly and strategically adopted the discourse of science and engaged in a process of conducting and developing what has been termed 'civic science', to provide alternative and persuasive formal arguments to support their opposition to the expansion of industrial growth (Eden, 1998; O'Riordan, 1998; Kerr et al, 2007). This strategy is supported and facilitated by SDCEA's alliance with the South African NGO, GroundWork[1], and international collaborators. Initially SDCEA employed 'lay knowledge' in their deliberations derived from decades of community experiences living adjacent industry. Lay knowledge is defined here as knowledge which is local, 'nonscientific', 'hard earned', 'less formally organized' and related to 'self identity' (Michael, 1992, 323). Eden (1998) characterizes this form of knowledge as incorporating " 'extended facts' including beliefs, feelings and anecdotes". These different knowledge resources of lay knowledge and formal scientific knowledge are alternately and opportunistically used in activist strategies and campaigns and in state deliberative processes for purposes of advocacy and putting issues on the political agenda.

SDCEA has explicitly pursued a strategy of deliberation and activist opposition by means of which they operate outside the channels of political influence while at the same time engaging internally within the state in statutory participatory processes (Barnett and Scott, 2007a; 2007b). It is in this variety of responses that science and knowledge networks are used as resources to leverage power.

However, there is a fundamental tension between the history of lay knowledge about pollution upon which SDCEA has relied to engage in the 'politics of shame', and the lack of official acknowledgement of subjective qualitative narratives. This is coupled with the lack of reliable data regarding the impacts of pollution on human health due to apartheid legislation, which allowed companies to keep their data secret from public scrutiny for 'security' reasons. It is not so much an issue of lay knowledge versus expertise/science, but rather that the task of movements has been to develop ways of producing and disseminating scientific knowledge to pressure state and capital, without undermining validity of lay knowledge. Thus a key strategy of SDCEA in their opposition of state sponsored industrial expansion and their claims for the right to clean and healthy living environment, is to translate the validity claims of lay knowledge into forms of knowledge that are effective in institutional contexts and affirmative. At the same time, SDCEA has lobbied for socially acceptable science to document the impacts of industrial pollution on human health. The aim of this paper is to understand the use of *civic science* and *networks of environmental knowledge* and expertise as resources to support movement's oppositional strategies, without undermining the validity of lay

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[1] groundWork is a non-profit environmental justice service and developmental organization working primarily in South Africa but increasingly in Southern Africa (www.groundwork.org.za)

knowledge. The case of south Durban is used as a lens through which to understand how environmental movements increasingly use science in both oppositional and deliberative processes, what Dryzek (1996) refers to as a process of 'dynamic democratisation', to achieve their oppositional goals .

Section two provides a discussion of the science policy interface while Section three describes the context of south Durban as a pollution 'hotspot'. Section four goes on to outline the creation and use of science as a strategic resource in promotion of the vision of the environmental movement in south Durban. Section five provides a summary of the paper and a concluding argument.

2) Civic science and ecological modernization

Policy making is increasingly taking place globally through deliberative processes in governance networks (Hajer and Wagenaar, 2003; Hajer, 2005a; 2005b) Environmental politics has become "an argumentative struggle in which actors not only make others try to see the problems according to their views but also seek to position other actors in a specific way" (Hajer 1995, 53). Political scientists are now focusing on deliberative processes of policy-making in the network society where there are many voices contributing to the environmental debates. Hajer (2005b) uses the term 'multi signification' to refer to the many meanings that different groups may place on environmental issues. In the face of this relatively new way of policy-making, there is 'institutional ambiguity', with little experience of the 'rules of the game' (Hajer, 2005b).

Understanding of community engagement at the interface of science and policy necessitates a critical engagement with ideas around 'democratic opposition' as well as with current thinking about environmental policy-making. In post-apartheid South Africa, environmental politics is predominantly framed within a scientific discourse. It is in response to this authoritative discourse that communities have reframed their oppositional interventions within scientific discourses. In South Africa, participation processes are mandatory in any state policy-making process to include the diverse voices of civil society. While political participation in policy-making is a key element of the process of democratisation, the 'delivery' discourse is as central to the meaning of democracy due to the high levels of inequality in service provision and jobs that are a legacy of apartheid (Bond, 2001; 2002). In this case, oppositional strategies are focused on challenging the state's legitimacy imperative and 'shaming' the state for not ensuring equality and social justice in this sphere. The following section below provides an overview of contemporary approaches to environmental management that frame the understanding and management of environmental issues and determine the procedures for the engagement of civil society with the state.

Ecological modernization has become the hegemonic environmental management discourse and has been institutionalized in developed and developing countries (Hajer, 1995; Christoff, 1996; Lee and George, 1998). Within this approach, sustainable development is increasingly being used as a policy framework since the 1980s for environment and development decision-making (O'Riordan et al, 2000; Urquhart and Atkinson, 2000; Scott, et al, 2001). Ecological modernization is an approach to environmental policy-making that attempts to reconcile capitalist development and

environmental protection (Hajer, 1995; Mol, 1995; Blowers, 1997; Blowers and Pain, 1999; Murphy, 2000). Ecological modernisation conceptualises the problem of environmental degradation as a matter of efficiency or management (Hajer, 1995; Dryzek, 1997). Environmental problems are therefore conceptualised as 'structural problems' that can be solved with better economic management (Dryzek, 1997). This instrumentalist approach emphasizes the centrality of the biophysical environment as the chief recipient of environmental impacts. The biophysical world is assumed as external to human life, to be utilised and managed to ensure human well being and progress (Garner, 1996). Ecological modernization is a project however, that is not only in the hands of corporations and business managers but requires an endorsement by the entire society for the "the ecological restructuring of capitalism" (Dryzek, 1997, 145). Through this restructuring process the state has become the facilitator of neoliberal economic development and therefore has a complementary relationship with capitalist business (Christoff, 1996).

Christoff (1997) provides a useful characterization of what he calls 'weak' and 'strong' ecological modernization. 'Weak' ecological modernisation includes: a technocratic and science based approach with a corporatist style of policy making, a focus on green issues and a neglect of social issues, such as poverty and inequality, and a neglect of the international dimensions of environment issues (Scott et al, 2001). It is within this approach that the discourse of sustainable development has been incorporated as a normative framework for reconciling environment and development (Oelofse et al, 2006). In the South African case, we can see this version of weak sustainable development at work in the overview of the south Durban Multi-Point Plan (MPP)[2] multi-stakeholder forum by the Deputy Minister of Environmental Affairs and Tourism:

> "the Multi-Point Plan was founded in a democracy with strong provisions for environmental protection and promoting the health and well-being of people in the Constitution and in the environmental policy framework. The strategic objective of strong environmental governance is not aimed at impeding industrial development but to promote sustainable forms of production and sustainable development such that South Africa can be globally competitive and a prospering democracy. One of the successful attributes of the plan is involving stakeholders in the decision making process thereby taking all views on board". (South Africa, 2004).

Weak ecological modernization has become entrenched globally as a dominant 'mainstream' approach to environmental management. It has been transferred to developing countries in what Sonnenfeld (2002) calls 'dependent' ecological modernization where the assumed conditions for its successful implementation are often not present or well developed. i.e., high levels of living, technical sophistication, democracy, and institutional capacity.

Despite the progressive environmental legislation in South Africa at the policy level, practice largely remains entrenched in the mainstream approach of weak ecological

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[2] The Multi-Point Plan was a five year multi-stakeholder process established by the Minister of Environmental Affairs and Tourism in 2000 in response to community activism against the high levels of air pollution in the South Durban Basin. The focus of the MPP process was on air pollution management at the local level and laid the foundations for the Air Quality Management Act.

modernization (Scott et al, 2001). The framing of current environmental management in the framework of sustainable development provides the rhetoric for masking adherence to a system that still pays lip service to the ecological modernist approach.

Ecological modernization, as the name suggests, is a modernist approach and adopts an expert led, science-based policy framework (Hajer, 1995). The argument within this approach is that because environmental problems are highly complex, the precise scientific nature of the problem needs to be understood in order to create an authoritative base for policy-making. In this way scientists and experts take on the responsibility for defining the problems and finding the solutions to environmental problems. Positivist science continues to provide a powerful discourse for justifying regulatory responses as it frames environmental problems and therefore the boundaries of political decision-making (Hajer, 1995; Fischer, 2003).

It is at this interface of science and policy where power is located. Power is "inherent in the knowledge claims and various practices through which specific scientific claims gain authority" (Hajer, 1995, 139). Through processes of deliberation in a range of policy-making forums and beyond through other media, opposing groups engage argumentatively with the purpose of imposing their claims to knowledge and leveraging power (Low, 2001; Hajer, 2005a; 2005b).

The environment is presumed to be the domain of natural scientists, thus environmental research science is framed within the empiricist or positivist philosophies. Hajer (1995) defines two types of science employed in environmental policy-making, namely research science and regulatory science each of which has its own function. *Research science* can be defined as research, which takes place in well established and historically stable networks that have strict code of practices, such as the peer review process for verification and publication (Latour, 1987; 1999; Hajer, 1995). Almost all research science, or what Kuhn (1970) terms 'normal science' occurs within shared philosophical frameworks, or paradigms, with agreed upon epistemological and ontological assumptions and associated methodologies. These philosophies and practices are historically embedded in cognate natural science disciplines and institutional structures and the products of knowledge production are contained chiefly in scientific journals (Hajer, 1995).

Regulatory science plays a different role, in that it does not seek to be 'puzzle-solving' but is commissioned to answer narrow questions defined by an outside actor, either the state or business. It is conducted chiefly by accredited consultants within networks that operate within a less well-defined set of philosophical assumptions and practices and is not published but rather stands as the expert knowledge base for policy-making (Hajer, 1995). Hajer (1995) also points to the growing importance of the 'civil legitimacy' of scientific research which is becoming increasingly important in the network society where a range of 'voices' have rights in participating in policy-making processes.

Environmental movements are ironically 'science-based' and have "an ambiguous deep connection with science and technology" (Castells, 2000, 123). Environmental movements employ science, even if it is 'bad science' to determine the impacts of industrial capitalism on nature and human well-being. Environmental movements rely heavily on gathering, analyzing, interpreting and diffusing scientific information about

the interaction between development and the environment. Recognising that science has been implicated in the cause of current environmental problems, environmental movements 'use science to oppose science for life' calling for a more holistic science that supports human well-being (Castells, 2000; Oelofse and Patel, 2000). Their argumentative scientific discourses call for a reframing of science rather than a negation of science.

In the South African context, democratisation of decision-making means that in principle all stakeholders in an environmental issue have rights to participate in the decision-making (Yanow, 2003; Scott and Oelofse, 2005). A wide range of new policy and legislation exists for the management of the environment in South Africa modeled on that of the developed world (Oelofse and Scott, 2002). The Environmental Conservation Act 73 of 1989 has been largely replaced by the much-acclaimed National Environmental Management Act (NEMA) (1998). This aims to provide a framework for integrating environmental management into all development activities and a basic set of rules of 'legitimate conduct' to include civil society in decision-making (Hajer, 1995; DEAT, 1998; Fuggle and Rabie, 1999; Scott et al, 2001). These shifts in policy have followed trends in the developed nations where the paradigm of ecological modernisation has become entrenched as the mainstream framework for environmental policy-making and planning, and can be called 'dependent modernisation' (Hajer, 1995; Seippel, 2000; Sonnenfeld, 2002).

Despite this apparent shift to include civil society in formal statutory environmental decision making forums or 'extended peer communities', which would provide the context for a post-normal science (Funtowicz and Ravetz, 1993), the state continues to support managed economic growth (Hart, 2003). In doing so, it concomitantly marginalises social distributive issues although paying lip service to inclusiveness (Dryzek, 1996; Weaver, et al, 1999; Young, 2000; 2001; Yanow, 2003; Scott and Oelofse, 2005). It is in this context that social movements strategically elect to mobilise outside these forums Miller, 2000). Although not the norm, there is evidence of instances where there are genuine shifts towards strong ecological modernization taking place in South Africa in 'pockets of innovation' (Oelofse, et al, 2006). Boyte (2004) uses the term 'shallow democracy' to describe the performance of inclusiveness where no real power sharing takes place and where there is a weak relationship between state and society .

The south Durban provides an empirical context to examine the processes whereby an environmental movement both deliberates with the state and actively opposes it through a range of strategies, and particularly through the production and use of information and science. The following section provides a context for these strategies.

3) Industrialization and pollution in south Durban

Durban is one of South Africa's key productive sites and plays a strategic role in the national economy. South Durban has become the second largest industrial zone in the country and provides employment and revenue for the city. It houses one of the largest concentrations of chemical and petro-chemical industries in the country, which are major sources of air pollution and hazardous waste. Two of the countries four oil refineries,

ENGEN and SAPREF, are centrally located in the zone[3].The other sectors of industry found in south Durban include pulp and paper, beverages, textiles, plastics, petroleum and motor vehicle industries, which have a cumulative impact on the environment (Monitor Company, 2000). This industrial core has been strengthened by the construction of the largest container terminal in the southern hemisphere and a number of recent investments in the chemical sector. This expansion has added to the long history of air, water and ground pollution in south Durban (Wiley, et al, 2002).

Toxic emissions from industries, particularly into the air, are a potential threat to the health of communities, workers, and the environment in south Durban. Poor industrial operating practices have led to periodic oil spills and industrial accidents with inadequate emergency strategies for workers and residents (Wylie, et al, 2002). Excessive heavy transport on residential roads, truck accidents, noise pollution and illegal dumping of toxic wastes are also serious problems in the area. Many of these industries operate with older and energy-intensive technologies that produce excessive pollution and hazardous chemical wastes (Wiley et al, 1996). The industrial impacts are more intense in the residential areas of Merebank, Bluff, Wentworth and Clairwood due to the close proximity of residents to industrial activity. The risk falls disproportionately on historically disadvantaged black communities. (See Figure 1)

Durban's local economy has suffered from a very low real growth rate in the 1990s and early 2000s (Monitor Company, 2000). In response to this, Durban has embarked on a re-industrialisation programme, which involves upgrading the older industrial area of south Durban. Work has commenced with the implementation of the South Durban Spatial Development Framework (SDSDF) (eThekweni Municipality, 2005). The proposed upgrading and improved transport technologies are aimed at attracting firms geared towards international trade. Central to this vision for Durban is the plan to upgrade the port to world-class standards (Daily News, 15 May 1997). These local plans form part of the government's national economic strategy to integrate South Africa into the global economy via the GEAR programme (Parnell, et al, 2002; Peet, 2002; Nel, et al, 2003).

Within this context a number of scenarios for development in south Durban have been proposed by a range on national actors. Firstly, the national plan to relocate Durban International Airport to the north of the city frees up land for further industrial development to the south. A further proposal, put forward by the parastatal Portnet, is for the massive redevelopment and expansion of the port. This process has already commenced. These two options, and a proposal that the south Durban industrial zone should be developed as a petro-chemical complex, present the possibility of dramatically increasing industrial impacts on surrounding communities (Peart and von Coller, 1997).

The major obstacle to these proposals is that the communities of south Durban live directly adjacent to the industries and are opposed to residential relocation (SDCEA, 2004d). Their concerns about the existing levels of air pollution and the poor quality of the living environment have been expressed vocally for many years (Scott, 2003; Chari, 2004). Environmentally racist planning practices commencing in the late 1930s and culminating in the apartheid era created a 'productive zone' surrounding by racially segregated 'racial group areas' to provide a pool of labour for the emerging industrial core of Durban (Scott,

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[3] SHELL and BP are the major shareholders of ENGEN and SAPREF respectively. These refineries therefore are majority owned by global petrochemical companies.

1992). The Indian and so-called 'coloured' areas of Merebank and Westworth/Austerville demarcated in this period lie directly adjacent to industries, and particularly close to the two refineries. These black residential communities in south Durban, like many others in South Africa from the 1970s, engaged in an ongoing civic struggle against the state in order to improve the quality of their neglected living environments and to meet their reproductive needs. This gave rise to urban social movements that were distinctively community based, such as the Merebank Residents Assocation (MRA) and the Wentworth Development Forum (WDF). Their reproductive struggles focused on predominantly 'brown issues' that relate to quality of life in the living environment (e.g. housing, education, open space provision, waste removal, transport) have been reframed as environmental struggles in south Durban in the post-apartheid era.

SDCEA is an alliance of community organizations from former Indian, 'coloured' and white residential areas surrounding the industrial core of south Durban. It is an alliance of 14 civic and residents organisations which was established 1996 and claims to be a multi-cultural organisation (SDCEA, 1998; Reid and D'Sa, 2005)[4]. The legacy of activist politics among the black member organizations, the rapid increase of industrial impacts expreinced by the communities, and the freedom in post-1994 to give voice to their protests, has led to the increase of environmental activism in south Durban with the growing involvement of a number of communities and organizations (SDCEA, 1998). The first protest by south Durban communities took place outside ENGEN when in 1995 the then President Nelson Mandela opened ENGEN's plant expansion. He met with the communities and promised that a policy would be formulated in order "that industry (would) come up with programs to reduce pollution" (Reid and D'Sa, 1995). The communities of south Durban have lived for decades in a degraded environment and have often had to face unresponsive industries and government in their quest for an improved living environment (Sparks, 2004). They now face the prospect of increased impacts with the re-industrialisation of south Durban since the late 1990s.

This combination of locational effects has resulted in the emergence of an environmental movement in south Durban, which is locally embedded, and has become nationally and internationally networked. (Barnett and Scott, 2007a; 2007b) It has established itself as the largest and most influential environmental movement in South Africa. SDCEA has engaged in collective action to challenge industry and local government regarding the current problems experienced by communities and the future development plans (SDCEA, 2006). The current opposition strategies of 'advocacy and lobbying' are aimed at the impact of air pollution on health; current plans to expand the south Durban industrial zone and the relocation of residents (Reid and D'Sa, 2005).

4). The Use of Civic Science as a Strategic Resource

One of the increasingly important strategies adopted by SDCEA is the undertaking or commissioning of 'civic science' to provide 'scientific knowledge' as a strategic resource. There are three ways in which SDCEA deploys this knowledge. Firstly, to 'frame' environmental problems and their solutions; secondly in oppositional advocacy, and thirdly in deliberative policy forums to support their arguments. In this section of

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[4] The community organizations that belong to SDCEA are …

the paper we will examine the different uses of civic science at different moments in the last decade.

4. i) Framing south Durban as a pollution 'hotspot'

The first moment when 'civic science' was employed was during the South Durban Strategic Environmental Assessment (SEA) which was the culmination of a 'greening' process commenced by the local government in Durban in the 1990s (Freund, 2001; Roberts and Diederichs, 2002). Durban was the first local municipality to adopt Local Agenda 21 (LA21) in Africa. LA21 is a knowledge intensive form of environmental governance and the first output of the process of integrating the LA21 principles into the development plans for Durban was a *'State of the Environment' Report* produced in 1996 (Hindson et al, 1996)[5]. This scientific evaluation identified south Durban as an 'environmental hotspot' because of the long-standing environmental politics in the area. In order to address this problem and provide a framework for all further policy-making in south Durban, the local municipality commissioned a Strategic Environmental Assessment (SEA), which was undertaken between 1996-7.

The south Durban SEA had eight specialist natural science reports, and the Social Assessment, which was a desktop study (Scott and Ridsdale, 1967). Initial qualitative community narratives contributed to the public participation process were rejected for being too 'emotional' and 'subjective'. Consequently, a 'scientific', quantitative study was commissioned to gauge the 'perceptions' of people living in south Durban (CSIR, 1998). Faced with this exclusion, communities strategically decided to remain out of the participation process.

The final report of the SEA proposed that the development of a petro-chemical industrial core would be the best future development path for south Durban necessitating possible relocation of residential communities. The report lacked acknowledgement of local community impacts and provided a key moment for communities to mobilize, firstly around the issue of 'not being heard' and secondly, around the issue of relocation. When the SEA was submitted to local government in 1999, SDCEA successfully framed the report as a set of recommendations for 'the forced relocation of black communities to make way for industrial expansion' and large rallies were held. It was because of SDCEA's mobilisation around this issue that the eThekweni Municipality never acted on the SEA report.[6]

SDCEA were thus organising at the local level around three connected claims related to citizen's rights (Douglass and Friedman, 1998). The first claim is the right for citizens to be heard in matters affecting their local interests related to living environment and community, which is entrenched in the South African Constitution. They hereby called for the democratization of decision-making processes and for transparency and openness of all government transactions, and for the accountability of the state to its citizens (Douglass and Friedman, 1998; Barnett and Scott, 2008, in Press). It was a particular claim for their local knowledge of the health impacts of industrial processes

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[5] This was stimulated by South Africa's adoption of the principles and policies of the United Nation's Local Agenda 21 (LA21) Programme (Urquart and Atkinson, 2000).

[6] Interview with Debra Roberts, Head of Environmental Branch, eThekweni Municipality, 30 July 2003.

be heard. They were also claiming their difference as historically marginalised and disempowered communities, which have special needs due to their historical location adjacent to industry due to environmentally racist planning. Thirdly, they were claiming as citizens their rights to satisfy their basic needs – the 'brown issues'- of employment, health, education, a clean and safe environment and access to resources (Douglass and Friedman, 1998). These rights are embodied in their Constitution (SDCEA, 1998). SDCEA increasingly uses a rights based discourse in their opposition strategies as well as claiming their political rights. It is important to differentiate between political rights that confer equality and socio-economic rights, which relate to the delivery of basic needs, especially in developing countries such as South Africa (Seleoane, 2001).

With the experience gained through the SEA process, which was led by scientific experts and used scientific 'facts' as the basis for its decisions, SDCEA began to strategize about producing its own 'civic science' in order that it might be 'heard':

> "Soon after its inception, members realized that the organization's credibility would lie with the quality of the information gathered on the various industries and on the many accidents and incidents that occur in south Durban" (Reid and D'Sa, 1995).

Besides highlighting the lack of official acknowledgement of qualitative narratives, the SEA formally exposed a lack of reliable official data describing the problem of air pollution and the secrecy around refinery data. Lay knowledge provided a large body of historically accumulated experiential knowledge pointing clearly to the fact that there were high levels of cancer in south Durban. Yet there was 'no scientific proof' of impacts. SDCEA continues to present the local lay knowledge while at the same time realizing the need in certain forums to have their own reliable source of quantitative scientific data.

A second moment in the process through which SDCEA 'framed' their argument was the publication of a week-long series of articles in a local newspaper regarding the impact of industry on health in south Durban. The media in South Africa have provided an increasingly efficient channel through which local experiences of communities can be placed onto the larger local and national stage[7]. Social issues related to marginalized groups are increasingly finding their way into the media in opposition the historically conventional sources of scientific information (Barnett and Svendson, 2002). SDCEA have perceived this new 'political opportunity' and media coverage of social movements has substantially increased since 1994.
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From its earliest days, SDCEA had always relied on its accumulated local, experiential knowledge, which remains a powerful resource in challenging the state's legitimacy imperative (Dryzek, et al, 2003). It was the reporting of this lay knowledge in a weeklong series in the local newspaper *The Mercury* that provided SDCEA with credibility and bargaining power and an opportunity to frame the environmental problems in south Durban[8]. A local environmental journalist, who had developed an interest and knowledge about community activism in south Durban, undertook an

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[7] Barnett and Scott (2007a) note that the redistribution of ownership of the larger media corporations with an increasing Black Employment Equity (BEE) stake since 1994, has also contributed to this process.

investigation into the allegation of increased levels of cancer in south Durban. He published his findings in a series titled *'The Poison in our Air'*, which consisted of five front-page articles of *The Mercury*, during the week of 11-15th September 2000 (The Mercury, 11-15 September, 2000). The information for these articles was sourced from the community members of south Durban and was in the form of experiential narratives about cancer related illnesses and deaths of specific people[9]. Each story was accompanied by a photograph and the name of the victim. The storyline that was established through this media strategy to frame the key issue in south Durban was 'air pollution causes cancer' and south Durban became metaphorically characterised as 'Cancer Valley'. Although not claiming that the information was scientific it was detailed enough to establish SDCEA's credibility through a systematic presentation of lay knowledge. This had a profound impact on local people. The series was highly controversial and sparked widespread response in other media, and from government. It challenged the state's legitimacy imperative and invoked the Minister of the Environment to set up a process, the Multi-Point Plan (MPP) as a deliberative forum to deal with the issue of air pollution in south Durban. SDCEA claim that they were responsible for the establishment of this Plan (SDCEA, 2004a).

4.ii) Science as a tool for activist opposition

As well as using knowledge as a means of 'framing' environmental issues, activist opposition is the second arena in which scientific knowledge has been used by SDCEA. There are a number of key moments when this strategy was deployed.

The employment of science by SDCEA is not simply a matter of contesting scientific/legal expertise but also producing and commissioning science of their own as well as devising innovative means of disseminating science to local communities. Since the commencement of the south Durban SEA, SDCEA became increasingly aware of the need to produce their own information and objective scientific knowledge and have access to scientific 'experts'. To do this they sought international funding which was obtained from DANCED[10] in 1998 allowing SDCEA to employ a chemical engineer to assist them with their inputs into the south Durban SEA and assist them in understanding the complexities of the productive processes of an oil refinery (SDCEA, 1998). More importantly, since there was a lack of trust of the scientific data produced by the state and industry, it was necessary to obtain reliable data and information. There was furthermore secrecy regarding the activities of the refineries due to the National Key Points Act of 1980, which was promulgated to protect installations that were vital and vulnerable for the country, such as oil refineries and power stations. These industries used their status as a Key Point to maintain secrecy regarding their emissions. They continue to do so although this is increasingly difficult under the new regime of transparency and openness stipulated by NEMA and recent legislation in South Africa to promote access to information. SDCEA continues to protest about the secrecy around air pollution data collected as part of the statutory required self-monitoring process by industry. SDCEA furthermore, did not trust this quantitative data produced by industry or the official data provided by the state. This lack of trust lies at the core of the conflict in south Durban between communities, the state and industry.

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[9] SDCEA through its affiliated community organisations was responsible for providing access to all the people interviewed by the journalist.

[10] DANCED was established in 1994 within the Danish Ministry of Environment and Energy to promote environmental sustainability with a focus on community development in developing countries.

Since science is the authoritative discourse for industry's claim that air pollution was at an acceptable level, science could also be used for proving otherwise. Thus, SDCEA began in the late nineties to use science to frame pollution as a problem. Up until that point, the existing 'command and control' environmental management system managed air pollution emissions to comply with a set of 'quality standards' via a permit (Hajer, 1995). If emissions were below these standards, air pollution was deemed not to be a problem. When on occasion the emissions rose above these set levels, these are termed 'exceedences', for which a warning is issued for a return to compliance and a small fine issued (O'Rourke and Macy, 2003). Such exceedences are explained away as deviations from the norm, rather than part of a larger problem.

The strategic use of science as a tool for activism has involved reaching out to international partners through networks of science and activism (See Barnett and Scott, 2007a). The two examples presented here are the series of studies funded by DANCED and the scientific support offered by the 'Bucket Brigade' which provided knowledge to refute industry's claim that air pollution was not a problem.

The first example is the production of scientific knowledge funded by DANCED for advocacy purposes. The DANCED funding, managed through a Danish NGO – Danmarks Naturfredning (DN), was used to undertake two scientific studies. SDCEA undertook a comparative study of a Danish refinery and the two south Durban refineries, namely ENGEN and SAPREF (SDCEA and DN, 2004b; 2004c). The report concluded that south Durban's refineries were an instance of 'dirty growth' due to outdated technology and was rejected by the refineries, which challenged the scientific basis of the study. The funding was also used to set up a GIS information system to collate, analyse and present a range of pollution related data. A series of large maps portraying the spatial distribution of types of air pollution complaints, the location of polluting industries, pollution incidents, population at risk, air pollution mapping and resident's anecdotal data regarding how they had been impacted by pollution.[11] The maps were presented at the World Summit for Sustainable Development (WSSD) in the NGO session on Corporate Accountability in 2002. SDCEA members have been trained in the use of GIS, and the maps were presented at south Durban schools. The maps produced have proved to be highly successful tools for mobilization of communities, advocacy, and environmental education.

The second example of 'civic science' for activist opposition is the application of the 'Bucket Brigade' methodology to south Durban[12]. From 2000, SDCEA began to expand its networking with international NGOs and donor agencies. With the assistance of GroundWork, a local environmental NGO, SDCEA in 2000 engaged the assistance of the Global Community Monitor (GCM), an international NGO that has established an air testing programme for 'fence line' communities called the 'Bucket Brigade' as a form of community environmental policing (O'Rourke and Macey, 2003). Air samples

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[11] Interveiw with Njoya Silas, post graduate student undertaking the GIS project for SDCEA, 20 September 2002

[12] This is a simple methodology whereby a sample of air is collected in a specialized bucket through a vacuum system. It can be used by local communities in polluted areas to do their own sampling of polluted air. The bucket is then couriered to the United States for testing for pollutants (Carte Blanche TV Progamme, 9 September 2000).

were collected around the refineries and analysed by the Environmental Protection Agency (USA).[13] The results revealed that the air contained a 'cocktail of carcinogenic pollutants' and included the chemical benzene. This served to reinforce the 'pollution causes cancer' storyline established through the Mercury articles in September 2002. The community now had credible and reliable scientific evidence that the industries were producing dangerous and toxic chemicals (See Barnett and Scott, 2008, in press).

Up until this period, air pollution monitoring had only involved the monitoring of Sulphur Dioxide (SO_2) as an indicator of pollution levels (Diab and Motha, 2007). The receipt of the results of the analysis of the 'buckets' of air collected by the Bucket Brigade revealed that the air samples contained a dangerous mixture of carcinogenic chemicals. This led to the adoption of the term 'toxic' by SDCEA and the people of south Durban when referring to the polluted air and the industrial sources of this pollution. In this was the air pollution problem was reframed and soon thereafter SDCEA developed an education environmental tour of south Durban dubbed the ''Toxic Tour' which has proved very popular advocacy tool.

'Civic science' produced by SDCEA is disseminated widely for both advocacy and educational goals through a range of channels. SDCEA has an ongoing programme of raising environmental awareness in local schools in south Durban Basin. The recent publication called *Applied Meteorology and Climatology in South Durban* (SDCEA & DN, 2004a) is aimed at educators and learners and is considered by SDCEA to be one of its successes (SDCEA, 2004b). Similarly, the dissemination of the technical reports on the comparative studies on oil refineries in Denmark and south Durban have raised levels of awareness about the operation of multinational oil companies operating in developing countries. The installation of Geographic Information System (GIS) in the SDCEA office produces pollution complaints and incidence maps for local schools and is used as an advocacy tool at meetings and in deliberative forums. SDCEA provides it knowledge products in the form of pamphlets, brochures, and newsletters free of charge. The Newsletter, *Community News* is produced quarterly and is distributed locally as well as internationally (SDCEA, 2002/3; 2004a). In addition, SDCEA actively organizes meetings, workshops and seminars, which serve a range of purposes, chiefly awareness raising and gaining the community's mandate for action.

Knowledge and information have been at the heart of activist engagements when SDCEA has mobilized the communities of south Durban to be able directly to represent their concerns to the state or business. One example of the use of knowledge in activist engagement took place to coincide with the WSSD in Johannesburg in 2002. A mass public hearing was held at the Fairvale School directly opposite ENGEN. Residents were invited to come and share their personal experiences of industrial impacts and with American activists who had challenged SHELL (SDCEA, 2002b).[14] The poster made the following call:

> "Bring your asthma pumps, crutches etc and join us to speak out against this mass abuse to create a cleaner, healthier environment for us all!!!" (SDCEA, 2002a)

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[13] Interview with Des D'Sa, Chairperson of SDCEA, 9 August 2003.
[14] Interview with R. Naidoo, Chairperson of the Merebank Resident's Association and 'Leader on the Ground' for the two events, 12 November, 2002.

The hearing was to collect lay knowledge and evidence to add to SDCEA's database of local knowledge. The hearing was then followed by a candlelit peaceful procession to the gates of ENGEN to deliver the memorandum.[15]

This event provided a challenge to industry and the state and drew on local grassroots support and global partners. The ENGEN hearing were symbolically powerful as they linked the hearing of environmental justices to the Truth and Reconciliation (TRC) hearings in South Africa, which logged the violence and human rights abuses under apartheid and were "unique in the annals of history" (South Africa, 2003, 1) . In this case, it was a formal public hearing of environmental injustices, a cathartic counter-ritual challenging the contemporary democratic society of South Africa (Scott, 2003). The strategy was successful in gaining media attention and presented SDCEA's message locally, nationally and globally, promoted international networking, exposed international corporations and local government for inaction, and mobilised support. At the core of this engagement was the transmission of information, whether qualitative lay knowledge or an empirical inventory. These sorts of occasions illustrate the strategic and opportunistic use of both lay knowledge and more factual empirical data, each providing SDCEA with instrumental power in communicating their vision and challenging the state and industry.

4.iii) Science for Deliberation

The third use of science by SDCEA has been in scripted formal environmental policy forums through the process of public participation and deliberation. Two examples are provided here, the Environmental Impact Assessment (EIA) processes in south Durban and the Multi-Point Plan.

The first example of the use of science for deliberation is SDCEA's engagement in the EIA processes as an 'interested and affected party'. Since 1970 when south Durban became consolidated as Durban's major heavy industrial area, industrial expansion has continued to take place. Since the mid nineties, SDCEA has contributed to "hundreds of EIAs … to challenge 'dirty' expansion programmes" (SDCEA website). SDCEA soon became established as the legitimate representative of the people of south Durban and was inundated by requests to engage in the statutory public participation processes for development applications. Since public participation is a statutory requirement of the EIA process in terms of the Environmental Conservation Act and has been reinforced through NEMA in 1998, consultants are forced to consult communities to determine the potential impacts of proposed developments. A recent study has found that EIAs undertaken in south Durban between 2000 and 2005 reveal weak public participation processes and a lack of adequate consideration of the social issues (Hoosen, 2005). This trend is not specific to south Durban and has been witnessed throughout the country (McDonald, 2002; Laros, 2004).

Consultation with SDCEA is sought to 'rubberstamp' EIAs and SDCEA have been severely pressured to provide responses and thus suffer from 'stakeholder burnout' – "Sixty-four EIAs in 18 months in south Durban". [16] To assist them SDCEA have commissioned engineers and scientists, to assist with input into the complex chemical

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[15] Interview with D Ramcharrund, SDCEA Steering Committee Member, 21 October 2002
[16] Interview with Bobby Peek, of Groundwork, 10 February 2004.

and engineering issues that are contained in these industrial EIAs[17]. SDCEA claim that their tireless efforts to be included in these decision-making processes has had some success and "has resulted in some companies changing to cleaner fuels and technology" (SDCEA, 2004b). SDCEA has called for a moratorium on EIAs in south Durban due to the ongoing 'industrial creep' resulting from current programme of re-industrialisation and the lack of attention to the cumulative impact of development in the area. The SDCEA/Danida 2007/2008 funded programme includes holding EIA workshops with community members to build capacity in the ability to understand the EIA process and foster the ability to provide comments and inputs into EIAs (SDCEA & Danida, 2006). A handbook has already been produced for this purpose.

Networking with local Universities has been a vital strategy for the production of 'civic science' and students from tertiary institutions have contributed scientific knowledge through action research to assist SDCEA (Edwards, 2005, Abboy, 2006). This process has been productive in providing SDCEA with methodological capacity to defend their methodologies and knowledge production processes. In 2006, a series of research methods workshops were held with representatives of SDCEA for a study commissioned by SDCEA on the public spaces of south Durban that were potentially threatened by industrial expansion via the city's South Durban Spatial Development Framework. Scientific knowledge was 'co-produced' by SDCEA, academics and students from the local university with SDCEA framing the research question, and collaborating in the sampling of respondents, the questionnaire design and the dissemination and collection of questionnaires (Abboy, 2006; Scott, pers.comm., 2007).

A second example of the employment of science in deliberative policy forums is through the much-acclaimed Multi-Point Plan, which was established because of the community protest and mobilization in south Durban culminating in the high profile *Mercury* reports in September 2000. Established in November 2000, the MPP aimed to establish an air quality management system for south Durban (South Africa, 2004). In addition to setting up this management system, the MPP undertook two health studies: a Health Risk Assessment and an Epidemiological Study to determine scientifically the impact of air pollution on human health. It was envisaged that it would be a multi-stakeholder forum with representatives from local, provincial and national government as well as civil society and environmental NGOs. Siva Chetty, previously a respected leader of the Merebank Residents' Association and employee of the eThekweni Municipality was appointed as the manager of the MPP with a view to establishing trust between communities and the state and providing the MPP with credibility. In the MPP forum, science was established as the 'neutral arbiter' of conflict and the frame for consensus. This was achieved through appointing independent international experts and obtaining external funding for the health studies. Furthermore, the air quality monitoring programme with eleven air pollution monitory stations was set up to produce 'credible air quality data', which were published for all parties to inspect and verify[18].

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[17] Some of this assistance has been voluntary, such as the input received from academics from the University of Natal, University of KwaZulu-Natal and the Durban University of Technology. Engineering advice has been funded through the original DANCED grant received at the time of their establishment in 1998 (SDCEA, 1998).

[18] Interview with Siva Chetty, Manager of the Multi-Point Plan, 6 February 2004.

The MPP has been rated as a 'success' for SDCEA and GroundWork albeit a governance system that is based on a 'science based policy making' approach which is characteristic of the weak ecological modernization form of environmental governance. A key product of the MPP has been the promulgation of the Air Quality Management Act, which became implemented in July 2006. This Act, according the Minister of Environmental Affairs and Tourism,

> "will establish a scientific basis for identifying our most polluted air, and the sources of the pollution. It will create air quality standards and regulate emissions. Perhaps most significantly it will empower all spheres of Government to act against those responsible for damaging air quality, providing for fines, licensing fees and the entrenchment of the 'polluter-pays' principle" (South Africa, 2004).

SDCEA continues to lobby for transparency and the free access to information. In their 2004 Quarterly report to the MPP, they protested that the National Key Points Act is still being used illegally by the refineries to withhold information necessary 'for protection of human rights' (SDCEA, 2004b). SDCEA maintain that this has led to suspicion and a lack of trust and 'disempowers' the communities. Thus scientific knowledge continues to be an area of contentious politics (Barnett and Scott, 2007; 2008, in Press). SDCEA has through their increased scientific knowledge and the recourse to the rich accumulation of lay knowledge, increased the accountability of regulators and industries and changed the face of air quality management in South Africa. Key here is connecting 'science' with the ordinary dispositions of communities where there is high level of suspicion about official sources. Through SDCEA'S activities, communities themselves are understanding the 'science' of industrial impacts and in doing so is establishing conditions for 'placing trust' through effective communication.

Conclusion

Environmental movements undertake a complex strategy of deploying lay and scientific knowledge in the process of 'dynamic democratisation' (Dryzek, 1996). They furthermore operate opportunistically both 'inside' and 'outside' of the state, in deliberative forums and through activist protests. Since science is the authoritative discourse and basis for policy-making in the prevailing approach of ecological modernization, environmental movements have turned to producing their own 'civic science' or commissioning research for their purposes. This is in response to historical lack of trust in official and business sources of knowledge. Knowledge networks provide a conduit for the expansion of their knowledge base and scientific capabilities. However, this does not counter the use of lay, experiential knowledge of human suffering through industrial impacts, which is employed to challenge the state's legitimacy imperative by invoking principles of social justice.

Through the empirical study of SDCEA in south Durban, the paper shows that science and lay knowledge are used alternately in different contexts to reframe the problems in south Durban and to put pollution on the agenda as a 'brown issue'. At the same time lay knowledge has been used to engage in the 'politics of shame' to broker power by exposing the state's neglect of community health and well being and reframe

environmental problems. Science is used as a tool in activist strategies of opposition to critique and expose industry's practices of pollution, industrial accidents, emission exceedences and use of 'dirty fuels'. Science is also used as a persuasive weapon in the deliberation process and for the mobilization of communities to provide mandates for action. Science and knowledge are also creatively disseminated to a range of publics to raise awareness and provide environmental education. These efforts have helped to establish conditions whereby ordinary people may place trust in the right kind of scientific knowledge, i.e. that which promotes human well-being. SDCEA is a model of movement organisation and mobilisation and provides knowledge and capacity for other similar communities in South Africa living around oil refineries. It is building capacity and experience and actively compiling a suite of its own research projects. However, it was recently noted that SDCEA must not fall into the trap of becoming too technocratic and must maintain its qualitative database of local knowledge (Danida/SDCEA Project Meeting, 10 January 2007). As Brosius (1999, 36) states this will lead to the naturalization of a discourse that excludes moral or political imperatives in favour of ...technoscientific forms of …intervention".

The employment of science by SDCEA is part of the shift away from 'normal science' to 'post-normal science' where a range of voices are now beginning to contribute to the framing and understanding of environmental problems. Science is being used to frame environmental issues, as a tool for activist oppositional strategies and as a key resource in deliberative policy processes. Post normal science is an extension of democracy and is gaining credibility as a new form of knowledge production through the inclusion of 'civic science' as well as lay knowledge. SDCEA's oppositional strategies are part of the complex process of policy-making in the network society and contribute actively to the process of deepening democracy. Environmental politics lies at the interface between science and policy and it is here that alternatives knowledges and values have been inserted via the process of 'dynamic democratisation'. Thus, whether engaging inside or outside the state, the 'civic science' produced by SDCEA is used in both deliberative as well as activist strategies to represent and empower local communities in their engagements with both the state and capital.

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Figure legend:

Figure 1: South Durban showing the proximity of residential and industrial areas