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Understanding Loweswater: Interdisciplinary Research in Practice

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Abstract

This paper reports on a scoping study, 'Understanding Loweswater', funded under the Rural Economy and Land Use (RELU) programme. It highlights the research and policy context supporting the need for this kind of interdisciplinary, stakeholder-inclusive research and explains the way that the research was carried out in practice. The scoping study identified some of the challenges of the interdisciplinary approach taken, as well as highlighted its potential for solving environmental problems that do not fit within the frame of a single discipline.

Keywords: *Catchment; expertise; interdisciplinarity; pollution; RELU.*

1. Introduction

In this paper, we report on an interdisciplinary scoping study funded under the Rural Economy and Land Use (RELU) programme.[2] The project was based around a very obvious but complex pollution problem affecting Loweswater, one of the smallest lakes in the north-west of the Lake District National Park, in the north of England. The aims of the paper are: first, to highlight how the scoping study came about and how it played out in practice; second, to outline some of the implications of the interdisciplinary approach for the way in which Loweswater's problems can be understood; and third, to explore the lessons and potential of the interdisciplinary approach adopted for rural economy and land-use research as well as for rural environmental policy.

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[2] The six-month scoping study began in July 2004 and ended in December 2004. Its aim was to assess the potential for expanding the range of knowledge and expertise included in solving the problem of pollution in Loweswater. The project was led by Claire Waterton and Steven Maberly of the Centre for Ecology and Hydrology at Lancaster. Jake Morris and Lisa Norton were part-time researchers. The study was conducted as part of the UK Research Councils' RELU Programme (project: RES-2254-25-0039). RELU is funded jointly by the Economic and Social Research Council, the Biotechnology and Biological Sciences Research Council and the Natural Environment Research Council, with additional funding from the Department for Environment, Food and Rural Affairs and the Scottish Executive Environment and Rural Affairs Department.

The scoping study was an exercise in thinking through how different forms of expertise could help solve the practical problems of land and water pollution in Loweswater. It drew on research examining scientific and other forms of expertise about science and the environment (e.g., Beck, 1992, 1995, 1998; Irwin, 1995, 2001; Jasanoff, 2004; Jasanoff and Martello, 2004; Leach, *et al.* 2005). Within this vein of research – which spans development studies, social theory, the sociology of scientific knowledge, and anthropology and sociology of science – scholars have sought to highlight the cultural nature of scientific methods, practices and knowledges. Using case study material for the most part, such research has demonstrated the way in which scientific or technical framings of real-world problems may powerfully define non-scientific knowledge as irrelevant to, or as misunderstanding the real nature of the problem (e.g., Irwin and Wynne, 1996). Leach *et al.* (2005) have recently documented the ways in which this body of research has now 'challenged the dominant assumptions of scientific and other powerful institutions' – in particular, assumptions that the public are ignorant of science and thus 'epistemically vacuous' (Leach *et al.*, 2005, p. 8).

This research has helped to form a widening recognition that 'publics have salient knowledges and critical perspectives that should be taken seriously as inputs into the planning, design and implementation of scientific interventions and development initiatives previously assumed to be the sovereign domain of expert scientific bodies' (Leach *et al.*, 2005). Consequently it has been influential in inspiring a number of participatory experiments and studies that range from understanding local perceptions of risky technologies (e.g., Irwin *et al.*, 1996) to reflecting on citizen participation in global policy-making (Jasanoff, 2004; Ellis and Waterton, 2004), to advocating the inclusion of lay, ethical and other non-scientific concerns at the early or 'upstream' stages of scientific research programmes and technical innovations (Wilsdon and Willis, 2004).

Debates about these participatory schemes and how they have played out in practice have often centred on the role of expertise. Whose expertise is legitimate? This has led researchers to conceptualise a general framework with which to assess the appropriateness of different kinds of expertise for specific problems or controversies (Collins and Evans, 2002).[3] Others have resisted Collins and Evans' framework, criticising the way in which they tend to centre expertise on a 'core group' of scientists involved in such controversies (Rip, 2003; Jasanoff, 2003; Wynne, 2003) and suggesting that a *general* framework for assessing expertise may be counterproductive because it is the experience of an intimate and full immersion in *particular* controversies that gives individuals authority (Lynch and Cole, 2005).

Building on these research debates and preoccupations, the RELU scoping study aimed to open up questions about the potential of scientific, policy and other forms of environmental knowledge for solving the pollution problem in the Loweswater catchment. In this small catchment made up of just 13 farm holdings, the potential of farmers' and farm families' knowledge was specifically identified as potentially complementing the more reductionist scientific framings of pollution in the lake. Before explaining how farmers' knowledge was investigated and how its potential for contributing to problem-solving at Loweswater was assessed, we give some

[3] The classification of Collins and Evans (2002) encompasses 'no expertise, interactional expertise, contributory expertise'.

background about the pollution problem at Loweswater (Section 1.1), about the policy context more generally (Section 1.2), and about how the RELU study came about (Section 1.3).

1.1. A rural economy and land-use problem

In recent years, Loweswater has experienced a number of toxic blue-green algal blooms that occur at various times of the year and can last for months. The blooms indicate deteriorating water quality, as documented by Bennion *et al.* (2000). They are unsightly and prevent direct access to the lake by animals. The problem has not gone unnoticed and a number of organisations and individuals with responsibilities for land and water management within the catchment have become involved in trying to understand and solve it. The Environment Agency (EA), with responsibility for enforcing the EU Water Framework Directive, is particularly keen to see an improvement in lake water quality in order for it to reach the directive requirement of 'Good Ecological Status' by 2010.

Although the algal blooms may potentially result from nutrient cycling within the lake and/or climatic conditions, the principal hypothesis is that they are a consequence of increased point and diffuse sources of pollution in the catchment, resulting, at least in part, from slurry holdings and slurry and fertiliser applications. This hypothesis stems both from inspections carried out by EA officers in the catchment in the past few years (Paul Thompson, personal communication) and from the evidence linking water quality deterioration to agricultural changes since the 1970s (Bennion *et al.*, 2000). As a response, the 13 farmers managing and owning the land in the catchment organised themselves in 2003 as the 'Loweswater Improvement Project' to address the deterioration in water quality by altering their agricultural practices and to find ways of addressing potential pollution sources on their holdings. In part, this resulted from the growing conflict between farmers and local stakeholders and the threat of punitive measures by the EA.[4] Following on from this, in collaboration with the farmers, a lake and stream sampling programme carried out by the Centre for Ecology and Hydrology (CEH) for the state Rural Development Service was begun in late 2004 (to be completed by January 2006). This work was specifically aimed at identifying farming impacts on lake nutrient levels and consequent impacts on algal cycling in order to ensure that appropriate action could be taken by farmers (if necessary) to address the pollution issue. The work was explicitly stakeholder-inclusive as well as interdisciplinary, combining aquatic ecology, hydrology and vegetation ecology, therefore linking land-use and water quality issues.

The combination of this interdisciplinary, stakeholder-inclusive scientific approach, and the positive stance towards understanding and managing the problem of pollution in Loweswater taken on by the farmers, presented an opportunity to expand the approach to catchment management by attempting to understand local thinking about the social and economic issues relevant to an understanding of pollution in the catchment. The two social scientists on the RELU scoping study[5] were

[4] Although the obvious commitment of farmers to resolving pollution problems in the catchment through the Loweswater Improvement Project encouraged the EA to hold back on this threat, at least temporarily.

[5] Claire Waterton and Jake Morris.

to add this dimension. Although this represented a novel and experimental move in the Loweswater context, such approaches had already been pioneered elsewhere globally (e.g., through the UNESCO Hydrology for the Environment, Life and Policy (HELP) programme). This programme, which has been adopted across a network of global sites, is described as a 'new approach to integrated catchment management' in the UNESCO HELP website, although the extent to which local residents and stakeholders are involved in policy and scientific negotiations within HELP projects appears to vary (Andersson *et al*., 2004). The HELP approach does, however, recognise the need for active involvement of both policy and facilitating groups (water and land resource managers) to set the policy agenda and ensure that the scientific results meet societal needs through the revision of policy and management practices (Andersson *et al*., 2004).

1.2. The wider policy and research context

The importance of taking a more integrated approach towards the management of the rural environment and to incorporate local knowledge as part of that process has been recognised for some time now, notably in development circles (e.g., Jones and Wallace, 1986; Hobart, 1993), within social anthropology (e.g., Stillitoe, 1998; Ellen *et al*., 2000) and science and technology studies (e.g., Van der Ploeg, 1993; Wynne, 1996). More recently studies have begun to try and understand stakeholder perceptions and practices around rural issues, and to recognise that these should be built into policy understandings and approaches wherever possible (Webler and Renn, 1995; Janssen and Goldworthy, 1996; Stillitoe, 2002; Carey *et al*., 2003, 2005; Leach *et al*., 2005). It has also been recognised that there is a need to experiment with ways of breaking out of a 'top-down', science-heavy mould in rural policy-making and to work with, rather than against or above the understandings of those that manage, use or own land and other rural resources (Harrison and Burgess, 2000; Stuiver *et al*. 2004; Hooper, 2005; Toogood, 2005).

Although land owners are, in principle, free to manage their land as they wish, in practice, they are increasingly constrained by government bodies with responsibility for maintaining rural land quality and function. Those that own and manage the land often find themselves under contradictory pressures regarding what they can and cannot do and feel misunderstood by the regulatory authorities 'managing' them (Lobley *et al*., 2004). This is an important part of the context in which the Loweswater Improvement Project was established.

1.3. RELU and 'Understanding Loweswater'

RELU's broad aim is 'to advance a holistic understanding of the major social, economic, environmental and technological challenges facing rural areas' (see Lowe and Phillipson, 2006, this issue). As a tripartite collaboration between three research councils, it is informed by two main premises: that the challenges of the contemporary rural environment cut across the expertise of many different disciplines; and that inclusive 'stakeholder involvement' is necessary in order to understand those challenges.

In various disciplines and dedicated research programmes (e.g., science and technology studies, anthropology of science, development studies, the Joint Agriculture and Environment programme (JAEP), the ESRC Global Environmental Change

(GEC) programme) some progress has already been made in the theory and practice of interdisciplinarity, enabling different disciplines to work together, as well as to work more with policy 'users' (Lash *et al*., 1996; Grove-White and Wynne, 1998; MacNaghten and Urry, 1998; O'Riordan, 1998; Verran, 2002). However, there have often been challenges. JAEP which ran during the early 1990s achieved multidisciplinary outputs but failed to integrate natural and social scientists. The GEC Programme's strength, on the other hand, was to link academic research and its outputs more closely to policy concerns in areas like environmental risks, the handling of uncertainty in environmental policy-making and environmental justice (GEC Programme, 1999, 2001; Green Alliance and the ESRC GEC Programme, 2000).

Within the RELU programme, there was a further chance for natural and social science researchers to attempt to work with each other as well as to work together with stakeholders in the UK, in an environment which was arguably much more open to and cognisant of the importance and challenges of interdisciplinary approaches than that which existed in the early 1990s (Klien, 1996; O'Riordan, 1998; Schoenberger, 2001).

In the Loweswater scoping study, 'stakeholders' were taken to be the 13 farmers managing and owning the land in the catchment, the National Trust, Defra's Rural Development Service, the Environment Agency, and the Lake District National Park Authority. CEH became involved in the catchment during 2004, having met representatives from the 'Loweswater Improvement Project' in late 2003. CEH were keen to provide scientific information to help farmers inform their practices and in turn to observe how management changes would affect the catchment. The work that was carried out by CEH (funded by Defra) concentrated on the lake itself and included an analysis of CEH-held long-term datasets on lake water quality (Parker *et al*., 2001), collection of monthly lake and stream sampling data for a full year, the construction of algal models and a simple nutrient load model based on land use in the catchment (Maberly *et al*., 2003; Elliott and Thackeray, 2004).

Through the RELU-funded scoping study, social scientists also became involved in Loweswater. From a social science perspective, the self-organisation of farmers within Loweswater and the kinds of practised and tacitly understood knowledges that they might bring to an ecological understanding of the catchment were seen as potentially relevant sources of 'local knowledge' that would, at the very least, complement scientific studies of lake water quality. Such local knowledge might also challenge the way that scientific surveys were carried out and help in thinking through alternative ways of monitoring, measuring and characterising water flow, water quality, and so on. Consistent with the research discussed in Section 1 (from within anthropology, development studies, and science and technology studies) and with social scientific research directed specifically at pollution problems (Wynne, 1989; Irwin, 1995, 2001; Irwin *et al*., 1996; Lowe *et al*., 1997; Simmons, 2003), the social scientists involved were of the opinion that without understanding the 'local knowledge' of this pollution issue, scientific and policy approaches could fail to see the problem as experienced by those most affecting, and most affected by it. Made in the absence of this locally grounded knowledge, 'solutions' or measures taken could potentially misfire. The RELU Understanding Loweswater Improvement Project went one step further than many of these studies in that it aimed to bring the various stakeholders together to explore the *potential for a weaving together* of local, scientific and policy-generated knowledge towards a more integrated and synthetic understanding of the issues at stake (Bowden *et al*., 2004). This was to be done

through a one-day workshop. In the limited time available, it was not to be hoped that a fully integrated understanding could be achieved. Instead, the aim was simply to assess whether it might be possible in future research to work collectively and to explicitly integrate different knowledges of the water quality problems at hand rather than to act within isolated research and professional/institutional cultures.

2. Methods

While on-going ecological work was carried out as described above, the sociologists' principal methodology for understanding Loweswater from the perspective of those who lived and worked in the catchment was to interview farmers and residents who lived around the lake. One-to-one semi-structured interviews were underpinned by a theoretical understanding that 'talk' both frames and constitutes reality (Garfinkel, 1967; Shotter, 1993) and that, if the aim is to understand other people's perceptions and understandings of the world (*their* reality), categories (like 'pollution') should not be imposed *a priori* by the interviewer. Rather, the interviewer needs to guide the interview/conversation while allowing those being interviewed to use their own categories, their own vocabularies and their own ways of expressing meaning around a particular issue (such as pollution in Loweswater). Thus the definitions of the issue by those who live and work in the catchment can be understood. These would be an important basis for the sort of community-based approach to catchment management approach suggested by Andersson *et al.* (2004).

Five separate one-day trips to Loweswater took place over a period of around six months from July to December 2004. During these trips, interviews and conversations (sometimes more than one with each family) took place with four different farming families and the National Trust (covering five of the 13 farm owners in the catchment), and with a local hotelier at Loweswater. One day was spent at the lambing sale where it was possible to talk to farmers more informally. An interview with an officer of the Rural Development Service helped interpret the funding regimes and policy changes that farmers were experiencing. These interviews and days in 'the field' were followed by an all-day workshop at the Kirkstile Inn in Loweswater in December 2004 which involved between one and three representatives from each of the institutional stakeholders mentioned previously, and the (farmer) leader of the Loweswater Improvement Project.[6] As highlighted earlier, the workshop was designed to provide an open forum for Loweswater stakeholders to appreciate and discuss the range of different perceptions of the problems facing Loweswater and to explore whether different bodies of expertise, including that of farmers, lay residents and the professional authorities concerned might be combined and cross-fertilised in positive ways in the future.

The workshop not only revealed a positive consensual vision of the catchment, but also highlighted the constraints upon individuals and organisations normally

[6] Those present at the workshop were representatives from: The National Trust (two individuals); The Loweswater Improvement Project (one); The Environment Agency (three); the Rural Development Service (two); the Lake District National Park Authority (one); the 'Bassenthwaite Project' (one); CEH (two ecologists); and Lancaster University (two social scientists). Four of 14 participants overall were researchers on the RELU scoping study.

preventing them from moving towards that vision. It became clear that for much of the time the stakeholders are, at worst, at loggerheads with one another (e.g., through EA enforcement orders on businesses in the catchment) and at best not communicating at all. This is not in any way unique to Loweswater or a reflection on the particular catchment but rather evidences the lack of emphasis placed on communication and the sharing and resolution of different perspectives on the problem at hand. For a brief day, however, the workshop made it possible for stakeholders to distance themselves from their perceived roles and from their own ways of characterising 'the problem', and to focus on exploring different understandings and perspectives in a co-operative and intellectually flexible atmosphere.

From the outset, the six-month scoping study encouraged communication between different actors through informal meetings, telephone calls and e-mails. The study involved only a small number of scientists (two ecologists and two social scientists), a factor which helped to ensure informality and ample opportunity for group discussion, the chance to experience the different approaches and languages of the various scientific disciplines as well as to become personally known to farmers and other stakeholders. The prior existence of the farmers' 'Loweswater Improvement Project' generated confidence that there was already a willingness for dialogue between farmers, environmental agencies and scientists around the issue of environmental change within the catchment.

In practice, exploring the possibility of understanding Loweswater from an interdisciplinary and multiple-stakeholder perspective translated into a number of co-existing and very different methodologies. All four researchers worked together during the workshop to create an appropriate environment in which stakeholders could cross-compare narratives and analyses, and where the researchers could witness the convergence and divergence of different understandings and narrative accounts of pollution issues.

The team of researchers were, in effect, compiling a kind of 'patchwork quilt' of different forms of expertise (including scientific, policy, lay and farm-specific) and beginning to piece them together, while withholding judgement about the relative validity of each contribution. This process was, in some senses, straightforward in that researchers each played to their respective strengths and gathered evidence most appropriate to their own expertise. However, this was also a process that entailed an agnosticism as to the accuracy or veracity of different accounts/analyses/narratives. In this respect, the research team was acting under a principle very similar to the methodological principle of 'symmetry' deriving from the 'Strong Programme' in the sociology of science (Bloor, 1976/1991). As a research team, we were not looking for the 'true' epistemological account; rather, we were trying to understand the potential contribution of different kinds of accounts that were explicitly acknowledged as being generated in relation to particular knowledge cultures and contexts. In this sense, the implications of the research aims – to explore, and broaden, the portfolio of ways in which Loweswater and its pollution problems could be understood – were particularly challenging, especially for researchers who were unused to withholding judgement on knowledge statements.

Four short 'stories' that surfaced, often through different actors spontaneously telling the same story from their own perspective during the semi-structured interviews and the workshop, serve to bring this challenge into further relief. In re-telling these narratives below, we convey how the RELU scoping study, using its different methodologies, demanded that all actors see different accounts of 'the problem' as

being shaped by the varied contexts and cultures[7] in which they were generated. This in turn demanded and enabled a developing understanding of the integrated nature of social, environmental and economic issues in Loweswater. The challenging implication of the research design was that researchers needed to hold all these accounts open, not necessarily as 'truth claims' or truthful stories, but as accounts that could help to contribute to an emerging, composite and differentially 'situated'[8] picture of pollution problems at Loweswater. As we shall see below, these stories also challenged the researchers' own implicit framings of the scoping study.

3. Accounts of Loweswater

3.1. Story 1: Backfiring policies

Story 1 highlights the importance of listening carefully to local definitions of 'the problem'. Rather than seeing non-scientific people as 'epistemically vacuous' (Leach *et al.*, 2005) or having no knowledge to contribute to an understanding of pollution in Loweswater, the story demonstrates the logic of the kinds of connections that local people, who have knowledge of historical and present farming activities within the catchment, sometimes make. Such narratives – epitomised by the quote given below – may seem *illogical* to those who do not know the history of farm policies and practices in the catchment.

> *Farms that had a lot of fell land have used ESA money and bought up lots of land, which puts pressure back in winter on the farmstead.*[9]

Farmers and residents told researchers that when the Environmentally Sensitive Area (ESA) Scheme[10] was introduced into the Lake District in 1990, farmers in the catchment were able to access payments for management changes (e.g., reduced sheep and cattle stocking levels, and fertiliser and slurry applications) which were aimed at increasing the quality of farmed habitats within the National Park. Paradoxically, however, an increase in capital enabled several Loweswater farmers to rent or buy additional land outside the catchment for summer grazing and to increase cattle numbers. This resulted in increased numbers of cattle being overwintered in sheds within the catchment. This rise in the number of overwintered cattle has contributed to increased levels of slurry run-off from sheds and farm

[7] Including the contexts of farm practices and farming culture, the context of disciplinary norms (for ecologists and social scientists) and the context of institutional cultures (e.g., National Trust, Lake District National Park Authority, etc.)

[8] The term 'situated knowledge' derives from the work of feminist Science and Technology Studies scholar, Harraway (1991). In brief, it acknowledges that all knowledge (including 'objective' scientific knowledge) derives from particular cultural, historical and institutional contexts. Instead of seeing this as a weakness, situated knowledge is accepted as being inevitable. It is also seen as a powerful concept in that it forces an openness to different, including non-dominant forms of expertise.

[9] Quotation recorded during the one-day workshop, Kirkstyle Inn, Loweswater, 7 December 2004.

[10] The Environmentally Sensitive Areas Scheme offered incentives to encourage farmers to adopt agricultural practices which safeguarded and enhanced parts of the country of particularly high landscape, wildlife or historic value.

yards ('point-source' pollution) as well as the quantity of slurry spread on fields ('diffuse' pollution). Additionally, bigger herds have required farmers to produce more silage for overwinter feeding, resulting in an increase in fertilizer use (outside the ESA area) and in the amount of silage stored on the farm. As one participant in the workshop remarked: 'ESA doesn't control what happens in the farm'.

This story highlights the necessity of allowing a broad perspective of 'the problem' to be articulated by those at the ground level. ESA payments are not automatically assumed to be connected to Loweswater lake pollution. Yet, by listening to stories about farmers' responses to ESA schemes, the scoping study found that there is an important connection. In effect, the uptake of the ESA scheme has contributed to deterioration in the environment of the Loweswater catchment in contradiction to its stated aims.

3.2. Story 2: Immutable policies

Under the National Parks and Access to the Countryside Act of 1949, National Park Authorities were established as the sole local planning authority for their area. The Authorities' planning policies and decisions must give great weight to conservation of the natural beauty of the countryside, and major development should not take place except in exceptional circumstances. Planning controls also mean that minor alterations to existing buildings must conform to a Lake District National Park aesthetic. This, farmers have argued, has inadvertently caused problems for Loweswater lake water quality.

Many of the farmers highlighted the problems caused by rain falling directly onto farmyards, resulting in increased levels of run-off from midden and silage piles as well as uncovered slurry tanks. It is widely suspected that this is a significant source of point-source pollution. 'The crux', as one workshop participant expressed it, 'is separation! Take out the rain water!' Many farmers had been keen to roof over their yards to prevent this pollution taking place. Under the planning controls imposed by the park authority, however, the roof of any permanent structure must comply with aesthetic/amenity considerations in respect of their location. This made it prohibitively expensive for farmers to cover their yards.

This story suggests that, paradoxically, in the case of Loweswater, the Lake District National Park Authority's planning controls, aimed at conserving the natural beauty of the catchment, have indirectly contributed to the area's environmental problems. By interviewing farmers, it was understood that the pollution problem in the lake was related both to conservation policies and to the price of roofing materials. As another workshop participant neatly put it: 'Not having a roof is not sustainable, either for the land, for people or for the community'.

3.3. Story 3: 'It's not about the lake!'

It soon became apparent, upon talking to one of the first interviewees in the scoping study, that there was a very troubling sense of uncertainty about the prospects for farming under proposed changes to the Common Agricultural Policy (CAP) at the time research interviews were conducted. Many hill farmers, including those in the Loweswater catchment, were predicting that their incomes were going to drop substantially and that their financial situation would very soon become untenable. The new Single Farm Payment scheme not only inevitably led farmers to worry about

the viability of their own farming enterprises, but it also resulted in tensions between farming families, as the new subsidy system was likely to affect them differently as a result of differences in their reliance on farming or other sources of income. Given this somewhat tense situation, it came as no surprise to the researchers that concerns about the lake had been temporarily shelved and that many farmers were not in a position to be talking and thinking about the pollution in the lake. In the words of one farmer's wife: 'It's not about the lake right now!'

Not surprisingly the priorities of farmers in the valley were shifting according to new more intense economic pressures and questions ('will we get through the next year?') layered on top of old concerns like effluent storage, effluent disposal and the poor water quality of the lake. By making it clear to the researchers at the beginning of the study that 'it is not about the lake!' farmers were letting us know, as researchers, that if we wanted to take on board farmers' perspectives on Loweswater and to look at the catchment in a holistic fashion, we would need to broaden our frame of reference. If we persisted in holding up for discussion in interview a 'research object' like 'pollution of the lake', we would gain little understanding of the way that farm livelihoods and environmental quality were seen by farmers to interact.

This story illustrates one of the difficult predicaments of this kind of stakeholder-inclusive research. Researchers' and other stakeholders' 'objects of study' (or 'definitions of the problem', e.g., pollution in the lake) turn out to be unstable, sometimes radically different in scale and scope (e.g., hill farm economics under a new CAP regime, against estimates of effluent run-off and lake water quality). This means either that a flexibility of focus is required, or that one party has dominance over the others in defining 'the object of research'. In this RELU scoping study, the researchers accepted that pollution in the lake was not necessarily always the object around which questions should be generated, and began to look more carefully at related economic and social issues. This implied, however, the need for a significant broadening of the terrain of the research. Researchers began to be aware of the risks of defining future research too broadly, where the depth of research questions may become compromised because of a perceived overarching need for breadth of coverage (Petrie, 1976).

3.4. Story 4: Conflict

The last story we present brought forth further challenges for the research as farmers and other residents around the catchment came up with conflicting ideas about how lake water quality might be improved. Farmers suggested reinstating management practices at the downstream end of the lake including dredging of the lake's outflow to 'flush it out' by increasing water flow and prevention of the encroachment and over-hang of vegetation on the lake shore through woodland management. Both practices had ceased since the property adjoining the outflow of the lake was bought by the National Trust for whom the idea of 'letting nature run its course' was very important.

The National Trust, as owners of one of the farms in the catchment, together with a large area of the surrounding wooded land and the lake itself, disagreed with farmers' proposed management prescriptions, arguing that re-instating these management practices would only degrade both the outflow (a valuable spawning site for freshwater fish) and the lake shore. In contrast, the National Trust saw

over-stocked farms and the previous farm subsidy system as the sole reason for deterioration in lake water quality. For them, the only solution was a reduction in livestock numbers and, crucially, the number of cattle overwintered in the catchment.

These two contested narratives heralded obvious conflict. But, rather than seeing this as a question of 'who is right?', the challenge to the researchers was to accept these narratives and to hold them in play, so that options were not, at this early stage in exploring alternative understandings of the lake, foreclosed. This also implied the challenge of respecting all participants as having valid sources of expertise, a stance that was difficult to accept for some who had been involved in scientific monitoring of water in the lake, or who held strong convictions about the solution to poor lake water quality.

4. Implications for Policy and Research

In this section, we turn to the implications of the research for policy, and for researchers attempting interdisciplinary, stakeholder-inclusive research of this kind. A conventional, instrumental understanding of the way in which policy-making can influence environmental conditions would result in the positioning of lake water quality as a central point of focus within a system of processes that influence it. These processes are conventionally assumed to be vertically integrated: policies influence the economic and social environment within which stakeholders operate (Fuller *et al.*, 2005; Firbank, 2005). This, in turn, conditions various land management responses, affecting the ecological processes which determine lake water quality. It is conventionally presumed that there can be a simple causal relationship between levels in the system although the extent to which these relationships are explored in any detail typically remains limited in many environmental studies (e.g., Wheater and Peach, 2005).

A close reading of the stories, however, positions lake water quality within a network of multiple and interacting players. The locally generated accounts of policy–environment relationships suggest that there is no simple and predictable causal relationship between the elements in the network. The stories show that policies, as interpreted and used by stakeholders who are also considering the social and economic environment within which they are operating, may have some very different outcomes to those intended. Land management responses are shaped by stakeholders' interpretations of opportunities and their own particular implementation of policies. Lake water quality may be determined by many different and interacting elements in the network, including the effectiveness of communication between participants (Figure 1).

Under this analysis, pollution in the lake is not caused by poor policy-making or bad science, nor by irresponsible stakeholders or land management practices, but by complex and somewhat unpredictable interactions between policies, stakeholders, land management and water quality. The stories have shown, for example, that application of the ESA scheme in Loweswater has paradoxically abetted a net worsening of environmental conditions in the catchment. Similarly, the Lake District National Park Authority's attempts to conserve the natural beauty of the catchment have made it more difficult for farmers to tackle the problem of point-source pollution, leading, in unforeseen ways, to a net decrease in the valley's aesthetic appeal.

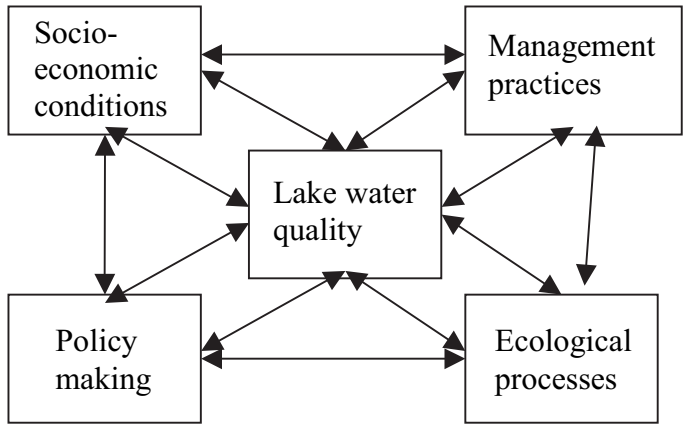

Figure 1. Lake water quality within a network of interacting elements.

Gathering stories based around local knowledge can usefully complicate understanding of policy–environment interactions, reminding us that not only are cause–effect processes in natural systems difficult to determine but that social, economic and policy processes may set in train equally complex interactions.

As the last two stories show, however, social science research designed to draw out and understand local knowledge in context has its own complications in practice. The assumption that researchers can define the object of study in advance of participatory or stakeholder-inclusive research can (and perhaps should) itself be challenged head-on by stakeholders, as we saw in Story 3 when farmers in Loweswater contested the idea that the researchers should focus predominantly on lake water quality. Interdisciplinary, stakeholder-inclusive research of the kind referred to in the introduction to this paper has been shown to be fraught with questions over whose knowledge and whose expertise counts, and what counts as expertise; whose definition of the problem is expected to remain stable, and whose has to shift; and whether, and how, an agreed common framing of a problem can be created (Cooke and Kothari, 2001; Collins and Evans, 2002; Jasanoff, 2003; Wynne, 2003; Strathern, 2004).

5. Concluding Remarks

We aimed in this paper first to highlight how the RELU interdisciplinary scoping study came about and how it played out in practice. The study, Understanding Loweswater, built into a context in which the active participation of stakeholders had already been recognised to be valuable by many parties. As one representative from the Environment Agency remarked during the stakeholder workshop:

> *Regulatory bodies don't have the power to deal with diffuse pollution. We need co-operation and participation from the local community. This is probably more important in the long run than the big stick.*

The study also built upon much previous academic research in anthropology, development studies and science and technology studies. It aimed to investigate the potential for a broader portfolio of knowledge and expertise to contribute to resol-

ving pollution issues in Loweswater. The results of the scoping study showed that exploring the local knowledge and expertise of farmers was one area where it appeared this portfolio could be usefully broadened.

In the paper, we have considered the way that the researchers carried out this interdisciplinary project. The call for interdisciplinarity in environmental policy and other development and planning contexts may have become a 'mantra', but researchers trying to 'do interdisciplinarity' also know that there remains a lot of variability in what the goals of interdisciplinarity are, how they are achieved, as well as critical debate as to whether they have been achieved at all (Stillitoe 2002; p. 17; Strathern, 2004). In the practical day-to-day work of the study, disciplinary boundaries were to some extent kept intact and upheld. This meant that particular ecological, sociological and policy understandings of Loweswater could continue to be generated.

However, even within a very time-constrained scoping study, natural and social scientists did work together with stakeholders in ways that revealed promise for future research of this kind. The sociologists' work interviewing farmers and residents began to expose the limitations of a purely scientific approach to understanding pollution problems at Loweswater. Both social and natural scientists began to anticipate some of the challenges and complexities that might be introduced by bringing in wider social, economic and epistemic issues into dialogue with a scientific and policy framing of the problem.

The considerable challenges of stakeholder involvement have been highlighted. When stakeholders see the need to re-orient the focus of the research so that it has greater relevance to their own experiences of the problem at stake (e.g., to farm policies and farm economics), those conducting the research need to make decisions as to whether they should accept a new framing of the study or whether they should insist upon their own prior framing (e.g., lake water pollution). Our goal was to assess the possibility and desirability of generating a holistic understanding of the social, economic and environmental interactions within the Loweswater catchment, in order to understand the catchment better. We also maintained theoretical concerns to build understandings of the catchment through the grounded experiences of participants (rather than through the preconceived categories of researchers). This translated into a need to draw on wider, more complex and interconnected economic/policy/land-use questions surrounding the issues of lake water quality. The problem of depth vs. breadth in interdisciplinary, stakeholder-inclusive research became clearly visible (Petrie, 1976).

The fact that a project may be interdisciplinary, we conclude, does not provide a road map of how to do research. In this scoping study, the addition of social scientific research (in the sociology of scientific and lay knowledge) to existing (and already interdisciplinary) scientific work underway at Loweswater bore fruitful results. Bringing together these different ways of doing research seemed to indicate that there are substantial gains to be made in expanding the repertoire of knowledge and expertise on the issue of pollution at Loweswater. Had social and natural scientists not, for example, juxtaposed local farming knowledge of environmental policy implementation against the ecological knowledge being generated about pollution in the lake, the paradoxical workings of the ESA payments and the slate-tile planning regulations of the National Park Authority might never have seemed relevant to questions of phosphorus pollution in Loweswater.

There are communicable 'lessons' for policy from this kind of interdisciplinary research on the social–natural environment. But, at the same time, there are important on-going questions about how to carry out interdisciplinary research, how to anticipate problems, how deeply to cross-interrogate the knowledge and knowledge practices of others, and how to create the possibilities for broad *and* deep stakeholder-inclusive investigations. In the future, we aim both to generate and bring together different forms of knowledge (including terrestrial ecology, aquatic ecology, sociology of scientific and lay knowledges, and economics) into situations where they might cross-fertilise and interrogate one another while looking for mutually agreed ways of building on the understanding of this catchment. The scoping study, and the stakeholder workshop that took place as part of that study, gave the researchers some evidence that this might be both possible and desirable in Loweswater.

References

Andersson, L., Bonell, M. and Moody, D. 'Foreword. Special Thematic Issue: Hydrology for the Environment, Life and Policy (HELP) Programme', *Water Resources Management*, Vol. 20, (2004) pp. 267–274.

Beck, U. *Risk Society: Towards a New Modernity* (London: Sage, 1992).

Beck, U. *Ecological Politics in an Age of Risk* (Cambridge: Polity Press, 1995).

Beck, U. *World Risk Society* (Cambridge: Polity Press, 1998).

Bloor, D. *Knowledge and Social Imagery*, 2nd edn (Chicago, IL: Chicago University Press, 1976/1991).

Bennion, H., Carvalho, L., Luckes, S., Boyle, J., Appleby, P. and Henderson, A. (2000) *Water Quality Investigation of Loweswater, Cumbria*, Final Report to the Environment Agency, March.

Bowden, W. B., Fenemor, A. and Deans, N. 'Integrated water and catchment research for the public good: The Motueka River-Tasman Bay Initiative, New Zealand', *International Journal of Water Resources Development*, Vol. 20, (2004) pp. 311–323.

Carey, P., Short, C., Morris, C., Hunt, J., Priscott, A. and Davis, M., Finch, C., Curry, N., Little, W., Winter, M., Parkin, A. and Firbank, L. 'The multi-disciplinary evaluation of a national agri-environment scheme', *Journal of Environmental Management*, Vol. 69, (2003) pp. 71–91.

Carey, P., Manchester, S. and Firbank, L. 'Performance of two agri-environment schemes in England: A comparison of ecological and multi-disciplinary evaluations', *Agriculture Ecosystems and Environment*, Vol. 108, (2005) pp. 178–188.

Collins, H. M. and Evans, R. 'The third wave of science studies: Studies of expertise and experience', *Social Studies of Science*, Vol. 32, (2002) pp. 235–96.

Cooke, B. and Kothari, U. *Participation: The New Tyranny* (London: Zed Books, 2001).

Ellen, R., Parkes, P. and Bicker, A. (eds.) *Indigenous Knowledge and its Transformations* (Amsterdam: Harwood Academic, 2000).

Elliott, J. A. and Thackeray, S. J. 'The simulation of phytoplankton in shallow and deep lakes using PROTECH', *Ecological Modelling*, Vol. 178, (2004) pp. 357–369.

Ellis, R. and Waterton, C. 'Environmental citizenship in the making: The participation of volunteer naturalists in UK biological recording', *Science & Public Policy*, Vol. 31, (2004) pp. 95–105.

Firbank, L. G. 'Benefits of organic farming to biodiversity vary among taxa', *Biology Letters*, FirstCite Early Online Publishing (DOI:10.1098/rsbl.2005.0357, 2005).

Fuller, R. J., Norton, L. R., Feber, R. E., Johnson, P. J., Chamberlain, D. E., Joys, A. C., Mathews, F., Stuart, R. C., Townsend, M. C., Manley, W. J., Wolfe, M. S., Macdonald,

D. W. and Firbank, L. G. 'Benefits of organic farming to biodiversity vary among taxa', *Biology Letters* (doi:10.1098/rsbl.2005,0357, 2005).
Garfinkel, H. *Studies in Ethno-methodology* (New York: Prentice Hall, 1967).
Global Environmental Change Programme. *The Politics of GM Food: Risk, Science and Public Trust* (Special Briefing No. 5, University of Sussex, 1999).
Global Environmental Change Programme. *Environmental Justice: Rights and Means to a Healthy Environment For All* (Special Briefing No. 7, University of Sussex, 2001).
Green Alliance and the ESRC Global Environmental Change Programme. *Steps Into Uncertainty: Handling Risk and Uncertainty in Environmental Policy-making* (Special Briefing No. 6, University of Sussex, 2000).
Grove-White, R. and Wynne, B. *Science, Culture and the Environment – Phase 2* (CSEC Report to the ESRC, Lancaster University, 1998).
Harraway, D. *Simians, Cyborgs, and Women: The Reinvention of Nature* (London: Free Association Books, 1991).
Harrison, C. and Burgess, J. *Biodiversity and Conservation* (Berlin: Springer Science + Business Media B.V, 2000).
Hobart, M. (ed.) *An Anthropological Critique of Development: The Growth of Ignorance* (London: Routledge, 1993).
Hooper, B. *Integrated River Basin Governance* (London: IWA Publishing, 2005).
Irwin, A. *Citizen Science: A Study of People, Expertise and Sustainable Development* (London: Routledge, 1995).
Irwin, A. *Sociology and the Environment* (Cambridge: Polity, 2001).
Irwin, A. and Wynne, B. *Misunderstanding Science? The Public Reconstruction of Science and Technology* (Cambridge: Cambridge University Press, 1996).
Irwin, A., Dale, A. and Smith, D. 'Science and Hell's Kitchen: The local understanding of hazard issues', in Irwin, A. and Wynne, B. (eds.), *Misunderstanding Science? The Public Reconstruction of Science and Technology* (Cambridge: Cambridge University Press, 1996, pp. 47–64).
Janssen, W. and Goldsworthy, P. 'Multidisciplinary research for natural resource management: Conceptual and practical implications', *Agricultural Systems*, Vol. 51, (1996) pp. 259–279.
Jasanoff, S. 'Breaking the waves in science studies', *Social Studies of Science*, Vol. 33, (2003) pp. 389–400.
Jasanoff, S. 'Science and citizenship: A new synergy', *Science and Public Policy*, Vol. 31, (2004) pp. 90–94.
Jasanoff, S. and Martello, M. L. *Earthly Politics: Local and Global in Environmental Governance* (Cambridge, MA; London: MIT, 2004).
Jones, J. R. and Wallace, B. J. (eds.), *Social Sciences and Farming Systems Research: Methodological Perspectives on Agricultural Development* (Boulder, CO: Westview Press, 1986).
Klien, J. T. *Crossing Boundaries: Knowledge, Disciplinarities and Interdisciplinarities* (Charlottesville: University Press Virginia, 1996).
Lash, S., Szerzynski, B. and Wynne, B. *Risk, Environment and Modernity: Towards a New Ecology* (London: Sage, 1996).
Leach, M., Scoones, I. and Wynne, B. *Science and Citizens: Globalization and the Challenge of Engagement* (London: Zed Books, 2005).
Lobley, M., Johnson, G., Reed, M., Winter, M. and Little, J. *Rural Stress Review: Final Report* (Centre for Rural Research, University of Exeter, Research Report 7, June, 2004).
Lowe, P. and Phillipson, J. 'Reflexive interdisciplinary research: The making of a research programme on the rural economy and land use', *Journal of Agricultural Economics*, Vol. 57, (2006) pp. 165–184.
Lowe, P., Clark, J., Seymour, S. and Ward, N. *Moralising the Environment: Countryside Change, Farming and Pollution* (London: Routledge, 1997).

Lynch, M. and Cole, S. 'Science and technology studies on trial', *Social Studies of Science*, Vol. 35, (2005) pp. 269–312.

Maberly, S. C., King, L., Gibson, C. E., May, L., Jones, R. I., Dent, M. M. and Jordan, C. 'Linking nutrient limitation and water chemistry in upland lakes to catchment characteristics', *Hydrobiologia*, Vol. 506, (2003) pp. 83–91.

MacNaghten, P. and Urry, J. *Contested Natures* (London: Sage, 1998).

O'Riordan, T. 'Interdisciplinary science and sustainable agriculture', *Environment*, Vol. 40, (1998) Cover page.

Parker, J. E., Abel, D., Dent, M. M., Fletcher, J. M., Hewitt, D. P., James, J. B., Lawlor, A. J., Lofts, S., Simon, B. M., Smith, E. J. and Vincent, C. D. 'A survey of the limnological characteristics of the English Lake District: The Lakes Tour 2000', (Report for the Environment Agency, North West Region, March, 2001).

Petrie, A. 'Do you see what I see? The epistemology of interdisciplinary inquiry', *Journal of Aesthetic Education*, Vol. 10, (1976) pp. 29–43.

Rip, A. 'Constructing expertise – In a third wave of science studies?' *Social Studies of Science*, Vol. 33, (2003) pp. 419–434.

Schoenberger, E. 'Interdisciplinarity and social power', *Progress in Human Geography*, Vol. 25, (2001) pp. 365–382.

Simmons, P. 'Performing safety in faulty environments', in B. Szerszynski, W. Heim and C. Waterton (eds), *Nature Performed: Environment, Culture and Performance* (Oxford: Blackwell, 2003, pp. 78–93).

Shotter, J. *Conversational Realities: Constructing Life Through Language* (London: Sage, 1993).

Stillitoe, P. 'The development of indigenous knowledge: A new applied anthropology', *Current Anthropology*, Vol. 39, (1998) pp. 223–252.

Stillitoe, P. 'Participant observation to participatory development: Making anthropology work', in Stillitoe, P., Bicker, A. and Pottier, J. (eds.), *Participating in Development: Approaches to Indigenous Knowledge* (London: Routledge, ASA Monograph, 2002, pp. 1–23).

Strathern, M. *Commons and Borderlands: Working Papers on Interdisciplinarity, Accountablity and Flows of Knowledge* (Oxon: Sean Kingston Publishing, 2004).

Stuiver, M., Leeuuwiss, C. and van der Ploeg, J. 'The power of experience: Farmers' knowledge and sustainable innovation in agriculture', in Wiskerke, J. S. C. and van der Ploeg, J. D. (eds.) *Seeds of Transition; Essays on Novelty Production, Niches and Regimes in Agriculture* (Assen: Van Gorcum, 2004).

Toogood, M. *Factors Affecting Farmers' Willingness to Participate in Biodiversity Policy* (Tilburg: European Centre for Nature Conservation, 2005).

Van der Ploeg, J. 'Potatoes and knowledge', in Hobart, M. (ed.) *An Anthropological Critique of Development: The Growth of Ignorance* (London: Routledge, 1993, pp. 209–227).

Verran, H. 'A postcolonial moment in science studies alternative firing regimes of environmental scientists and aboriginal landowners', *Social Studies of Science*, Vol. 32/5–6 (October–December, 2002).

Webler, T. and Renn, O. 'A brief primer on participation: Philosophy and practice', in Renn, O., Webler, T. and Weideman, P. (eds.) *Fairness and Competence in Citizen Participation: Evaluating Models for Environmental Discourse* (Dordrecht: Kluwer, 1995, pp. 17–35).

Wheater, H. S. and Peach, D. 'Developing interdisciplinary science for integrated catchment management: The UK lowland catchment research (LOCAR) Programme', *International Journal of Water Resources Development*, Vol. 20, (2005) pp. 369–385.

Wilsdon, J. and Willis, R. *See-through Science: Why Public Engagement Needs to Move Upstream* (London: DEMOS Publication, 2004).

Wynne, B. 'Sheepfarming after Chernobyl: A case study in communicating scientific information', *Environment*, Vol. 31, (1989) pp. 10–15, 33–39. Reprinted in Bradby, H. *Dirty*

Words: Writings on the History and Culture of Pollution (London: Earthscan, 1991, pp. 139–160).

Wynne, B. 'May the sheep safely graze: A reflexive view of the expert–lay knowledge divide', in Lash, S., Szerszynski, B. and Wynne, B. (eds.) *Risk, Environment and Modernity: Towards a New Ecology* (London: Sage, 1996, pp. 44–83).

Wynne, B. 'Seasick on the third wave? Subverting the hegemony of propositionalism', *Social Studies of Science*, Vol. 33, (2003) pp. 401–417.