Understanding and Acting within Loweswater: A Community Approach to Catchment Management

Case for Support

Intoduction and Rationale

The relatively isolated catchment and community of Loweswater[1], situated in the north west corner of the Lake District National Park, is host to a number of inter-related ecological, economic and social problems. These types of complex problems are not uncommon in rural, agriculturally dependent communities and include: environmental pollution, economic stress, dysfunctional communication and a sense of impending threat to community viability. Such interconnected problems are not always visible, and may even be obscured by preconceived notions about a harmonious nature-society balance in rural areas – the so-called 'rural idyll' (Newby 1979, Howkins 2003).

One obvious symptom of the environmental problems in the catchment is the appearance of unsightly and potentially toxic blue-green algal blooms on the lake. Analysis of historical data has shown clear evidence for a decline in water quality over the last 25 years: concentrations of total phosphorus and phytoplankton chlorophyll have increased and oxygen concentrations at depth have decreased (Maberly et al. 2006). There is also a local perception that brown trout populations and game angling have declined in line with the deterioration in water quality, leading to conflicting local views on how the fishery should be managed in the future (Buttermere and Ennerdale Property Fisheries Review Meeting, December 2005). A provisional assessment of water quality at Loweswater in terms of the Water Framework Directive suggests that water quality is only 'moderate' (Maberly et al. 2006) and thus future management action will be needed to achieve the 'good ecological status' required of such water bodies by 2015. The decline in water quality is associated with increased point and diffuse sources of phosphorus in the catchment, both from residential (domestic and hotel septic tanks) and farm sources (slurry holdings and slurry and fertilizer application to fields) over recent decades, although the relative contributions of each source and the soil and water processes leading to pollution of the lake remain uncertain. The problem is hence a multi-faceted one: it is related both to agricultural and domestic/hotel practices, the infrastructures available for dealing with waste, interactions with local and national regulators, social and policy issues and ultimately negative effects on the local economy through reduced tourism and possibilities for recreation and through the possibility of direct fines from the Environment Agency (EA).

In response to EA enforcement orders being placed on several properties and wider concern about the impacts of farming on water quality the 13 farmers managing and owning land in the catchment organised themselves in 2003 as the 'Loweswater Improvement Project' to find ways of reducing pollution sources from their holdings. Subsequently (2004-05), a study funded by the Defra Rural Enterprise Scheme was carried out by the Centre for Ecology and Hydrology (CEH) to try to gain a more detailed picture of lake processes and to understand the potential contribution of farming practices to lake pollution. Concurrently, a RELU scoping study presented an

[1] The 'catchment' is defined as the watershed. The 'community' is defined as those residing within the watershed. However, the researchers recognise that other relevant boundaries overlap – e.g. the 'Parish' does not map directly onto the watershed.

opportunity to expand the perspective on pollution in Loweswater by attempting to understand more about the relevant social, economic and policy issues in the catchment. This proposal is based on these three initiatives and particularly the insights derived from the scoping study.

Insights from the scoping study: the scientific and technical issues to be addressed

In order to place physical cause-effect questions around phosphorus pollution problems in the catchment into context, and hence suggest how responsible parties might go about addressing and abating them, the scoping study concluded it would be necessary to:

1. link *aquatic and terrestrial ecological* knowledge;
2. understand how *economic issues* for those living in the catchment *affect resource use and management* (including waste disposal), and hence also the aquatic and terrestrial ecology;
3. understand the way in which *institutional arrangements* pertaining to agriculture, water resources, environmental protection, economic regeneration, local government, tourism and recreation shape opportunities and constraints for catchment management;
4. understand the role of local culture, local knowledge and understanding, social mores and relationships in shaping land and resource use and management in the catchment.

Most importantly, the study saw the potential to move away from a 'command and control' regulatory style of management of the pollution issue and to innovate with a new institutional approach to address catchment problems and opportunities using a bottom-up approach.

The EA enforcement orders placed on holdings with obvious septic tank problems put pressure on individuals who did not have the capacity to respond appropriately. This was recognised by the EA who were willing to work with them and give them time to find appropriate solutions. Similarly the scoping study illustrated the commitment of other stakeholders involved in the catchment to attempt a more open and shared ownership of Loweswater's pollution problems with an emphasis on co-operation and commitment rather than legal and economic coercion in the form of pollution fines (Waterton, Norton and Morris forthcoming). During the course of the scoping study it became apparent that there is an opportunity in Loweswater to experiment with new institutional mechanisms involving the sharing of expertise, deliberative and negotiated planning, self-organisation and social learning following many aspects of Integrated Catchment Management and recent developments in the theory and practice of technical democracy (Latour 2004; Callon et al 2001; Rabeharisoa and Callon 2004).

Proposed project

This proposal is for researchers at Lancaster and Loweswater to undertake an interdisciplinary study, aimed at sustainable catchment management, that involves the local community and stakeholders, and that will ultimately be shaped by a new institutional mechanism or 'new collective' (Latour 2004) comprising researchers, the local community and other relevant stakeholders. The new institutional mechanism will be set up by the local community, stakeholders and researchers as part of the research project. It will be called the Loweswater Knowledge Collective (LKC) and is based on

the 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' (Leach, Scoones and Wynne 2005, Irwin 1995, Irwin 2001). The LKC will be able to propose additional research (a budget of £35k has been allocated). An Advisory Group comprising of up to 12 academics and stakeholders will be appointed to oversee and give guidance to the LKC.

The proposed research is both timely and appropriate for the RELU programme, which itself can be seen as a programme of its time, addressing the 'cracking up of the modern project, as overlaps and overflowings [or 'externalities'] proliferate' (Callon et al. 2001). RELU plays into the predicaments that modernity, with all its disciplinary and institutional boundaries, throws up, addressing the socio-technical controversies and problems of the modern rural environment through novel interdisciplinary modes of inquiring and acting. The proposed research directly addresses the RELU cross-cutting theme of 'identifying appropriate mechanisms for integrating social, economic and environmental goals in monitoring and management of change'. It goes one step further, perhaps, in that it aims to build a new institution capable of producing visions of change and actions to bring it about.

The research has three main objectives.

Objective 1 - Creating a new institutional mechanism – the 'Loweswater Knowledge Collective' (LKC)

The first objective of the project will be the creation of an institutional mechanism (the LKC) that will assemble the different forms of expertise needed to enable community- and stakeholder-involved decision-making within the catchment. In setting up this community/researcher/stakeholder research and management institution there will be demonstrable overlaps with other examples of catchment management initiatives (Andersson et al. 2004; Bowden et al. 2004; Wheater and Peach 2005, Hooper 2005). The proposed study will benefit from the investigators' experience in this area. Firstly, the experience that the researchers have already gained from working both on the scoping study and on other projects in the catchment. Secondly, the experience of Nigel Watson in the area of *collaborative* catchment management. Thirdly, insights from the sociology of scientific and other forms of expertise will also be relevant: what we propose is the creation of a 'reflexive organization' – one that 'constantly questions the procedures and tools enabling it both to learn, i.e. to accumulate competence and knowledge produced collectively, and to evaluate this competence and knowledge so as to decide on future actions' (Rabherisoa and Callon 2004). One focus for the collective will be the construction and maintenance of a database along with a user-friendly query system to be made available on a project web-page. This will hold all the different types of data available and collected by the project as a resource for the local community and stakeholders and will promote a sense of collective ownership and purpose to the project.

Objective 2 – Creating a catchment knowledge-base

The second objective will consist of high quality interdisciplinary research, envisaged as necessary by the previous scoping study in order to produce a catchment knowledge-base to inform decision-making. This will take the form of two overlapping 'research

clusters' that will interact and cross-fertilise each other through the LKC, as well as through existing research networks.

Research Cluster 1: Economic value, land and water
Research Cluster 1 has three aims:
1a) Terrestrial Ecology and Farm Economy
To understand the actual and potential *ecological and economic* value of land in Loweswater. and the relationships between them.
1b) Linking Terrestrial and Aquatic systems
To assess, monitor and model the relationship between land/waste management in the catchment and *water quality and biotic diversity* in the lake.
1c) Creating community and stakeholder informed decision-support mechanisms
To engage with the stakeholders in the research and to create community and stakeholder informed decision-support mechanisms for sustainable land, water and fishery management in the catchment.

Research Cluster 2: Social, institutional and environmental interactions and the creation of new perspectives
Research Cluster 2 also has three aims:
2a) Institutional and policy context
To understand the legal, political and administrative structures, processes and mechanisms in order to see how Loweswater's social and natural environment might be managed and develop.
2b) Local knowledge
To understand local perspectives and knowledge of Loweswater and investigate lay understandings of its social, cultural, economic and environmental dynamics, problems and opportunities.
2c) Cross-fertilising local, scientific and policy knowledges
To cross-interrogate the results of the different research strands (1a, 1b, 1c, 2a, 2b) from an interdisciplinary perspective to identify potential changes in framing, changes in research question, shifts in method that may be needed to address issues of social, economic and environmental sustainability in the catchment.

The knowledge base will not only *involve* the local community and stakeholders, it will, in time, be *shaped* by the LKC's perceptions of the issues that require further research and the kind of research questions that need asking (Rabeharisoa and Callon 2004). The elements within the research clusters will relate to one another through the phasing of the research project (see 'Programme of Work' below).

Objective 3 – transferability of research
Loweswater is of course a unique catchment, characterised by its own physical, economic, institutional and social dynamics. It is becoming increasingly recognised, however, that case-studies need to be complemented with non-place-specific and transferable conceptual work on environment-society relationships. The third objective will consist of research and analysis that considers the *transferability* and *potential for social learning* of the research in Loweswater. There will be lessons (both positive and negative) for catchment management and rural land use in particular, but also for other areas of scientific and technological problem solving that combine conditions of scientific uncertainty with a strong user-researcher interface.

METHODS

Objective 1: Creating the Loweswater Knowledge Collective

The groundwork for the establishment of this mechanism has been underway since the initial RELU scoping study. Researchers have kept in touch with several of the key stakeholders and informed them of the possibility of creating this proposal for further research on the catchment. A current project jointly funded by the Environment Agency and CEH (details on JES form) has spanned the gap between previous research projects and this proposal. Others most directly involved that have given their support to the proposal and are likely to be involved in the Collective are: the Parish Council, the National Trust (who own one farm, the lake and land adjoining the lake), the Loweswater Improvement Project (made up of the thirteen beef and sheep farmers within the catchment), the Rural Development Service, the Lake District Still Waters Partnership, Rural Regeneration Cumbria and Voluntary Action Cumbria. The deputy chairman of the Parish Council, also a farmer within the Loweswater Improvement project has agreed to become a Community Researcher on the RELU project, working one day per week in this role.

We envisage the setting up of the LKC to take place within the first 7 months of the project (by September 2007). Thereafter we will establish a programme of meetings every 2 months over the remaining two and a half years. These will be structured, themed meetings, with time given for both formal and informal communication. Meetings will be facilitated by the Lancaster researchers and the Community Researcher together. All meetings will include: a) news - relevant events, initiatives etc.; b) updates on research packages; c) a themed and facilitated discussion.

Claire Waterton, Nigel Watson, the Lancaster RA and the Community Researcher will record, minute and archive the content of meetings in order to derive important points and agreements from them for subsequent follow-up. In part, therefore, the methodology for Objective 1 is relatively conservative – for the main part consisting of good democratic principles for communication and protocol in organising and facilitating meetings. However, the LKC is a radical innovation that could: level out hierarchies and boundaries among institutions, community and individuals; allow for critical engagement by all actors with research and community agendas; create the scope for a blending of previously distinct agendas of research and action; foster a sense of agency in terms of environment-society relationships in the catchment. The researchers' main task, therefore, is to provide a platform for the smooth functioning and, in time, the self determination of the organisation.

Objective 2: Creating a catchment knowledge-base

Research Cluster 1: Economic value, land and water

1a) Terrestrial Ecology and Farm Economy

i) In order to measure the ecological and landscape value of the land a detailed assessment of the current biodiversity of vegetation and landscape character of the catchment will be made by ecological surveyors. This fieldwork will concentrate on quantitative data collection through measuring diversity of plant species across the catchment using quadrat sampling and landscape survey to record landscape features contributing to landscape

character e.g. hedges and walls. Methods used will be in common with those used for Countryside Survey (Haines-Young et al. 2000). This work will build on previous data collected in the catchment by the National Trust on their land. It will also provide a comparison to basic vegetation survey work carried out by CEH in the catchment in 2002 as well as being comparable to survey work carried out across other land under Environmentally Sensitive Area agreement in the same year (Carey et al 2005).

ii) An agricultural/economic assessment of the catchment will be made in conjunction with the farmers and others responsible for overseeing and advising on land management in the catchment. Field visits carried out jointly between farmers and land management advisors (e.g. RDS advisors, farm business advisors from Rural Regeneration Cumbria) will be observed by an ecologist and the fulltime Research Assistant in order to record data about the perception of land quality from farmers' and advisors perspectives and the agricultural assessment of land. Data collection during these field visits will include quantitative information on ESA agreements such as stocking densities, fertiliser applications etc. both historically and currently. The quantitative data will provide a vital link between the aquatic and terrestrial ecosystems. Qualitative information will be collected through interview or, where appropriate, questionnaires based on previous farm surveys (Fuller et al. 2005) and will include farmers' perceptions of what constitutes good quality land and the influence of changing economic drivers on land management. This survey work will take place predominantly in the second year of the project and will be carried out by the ecologist on the project (Lisa Norton) with the full-time Research Assistant.

1b) Linking Terrestrial and Aquatic Ecological Monitoring

i) Through the Loweswater Improvement Project and other initiatives attempts are currently being made to reduce phosphorus loads to the lake. In order to document any changes in water quality resulting from changed management within the catchment, a monthly lake monitoring programme, using standard techniques (see ii. below), will be carried out for the 3 years of the project. This will also enable comparisons to be made with the 12-month study carried out between September 2004 - 2005.

ii) A meteorological station and lake monitoring equipment will be installed on a buoy on the centre of Loweswater. A station, which costs about £50,000 to manufacture, is already available and will be provided at no cost to this project. Data will be down-loaded by telemetry and the equipment serviced during monthly monitoring visits. The lake data will include a thermistor chain to record temperature profiles, sondes recording oxygen concentration, temperature, pH and conductivity at surface and depth, and a surface fluorescence monitor to measure phytoplankton chlorophyll *a*. In order to help to increase the level of engagement of the local community with the lake and its problems and the research being carried out thereon the data will be made available on the project web-site. In addition the meteorological data will be used to drive a lake model, and the in-lake data will be used in model validation.

iii) The current fish populations of the lake will be assessed for species composition, abundance and age structure using standard gill-netting techniques and state-of-the-art hydroacoustic surveys in line with emerging EU Water Framework Directive guidelines which will give quantitative information on fish abundance and depth distribution (e.g. Winfield, 2002; Godlewska *et al.*; 2004). Existing Environment Agency data on young salmonids from electrofishing surveys of its tributaries will be evaluated to assess whether the apparently low brown trout

population is caused by the conditions for adults in the lake or for the young in the streams.

1c) Creating community and stakeholder informed decision-support mechanisms

i) Data from the research on terrestrial ecology and farmland economy will be combined in order to identify links between management practices (both current and historic), the agricultural/economic potential of land and the environmental quality of both land and lake under a range of potential policy drivers. The construction of a GIS catchment model will make it possible to visualise land use options for the catchment based on data collected on Loweswater's farms in a way that is generally accessible. Hence models for potential land management options will show what the catchment landscape would look like together with an indication of its ecological quality given the choice of particular management options as well as providing information on the economic viability of those options for those managing the land. Where possible (i.e. in relatively simple management parameters, such as stocking levels) the GIS model will also incorporate the potential impacts of land use options on lake water quality (see below) through links to the decision-support system being developed by the aquatic ecologists.

ii) The lake algal model, PROTECH, will be used to forecast the response of the lake to changes in the catchment (Reynolds et al. 2001). The model runs on a daily time-step, is driven by data on meteorology and nutrient input and will be used to forecast in probabilistic fashion (using 20 years of weather data) total phytoplankton biomass and functional types. PROTECH will be run for different management options, singly and in combination, with consequential varying load of phosphorus to the lake. Daily nutrient loads will be derived using the model GWLF (Schneiderman et al. 2002) which is driven by rainfall data that will be collected on the monitoring station. It is beyond the scope of this project to undertake the measurements needed for a detailed nutrient budget to the lake. Instead, literature values, expert opinion and emerging consequences of Best Management Practices for controlling diffuse pollution (e.g. Vinten et al. 2004) will be used to assess phosphorus loads. The model output will be used to inform a simple decision-support system that will be available on our web-site so that the local community, regulators and stakeholders can assess and visualise the effects of different management options on the water quality in the lake. Such options (e.g. changing the head of cattle in the catchment, changing the rate of phosphate fertiliser application and management of farm and domestic waste) will be addressed within the context of the LKC meetings in addition to other fora.

iii) A sustainable management plan for fisheries in Loweswater will be devised, with management options to improve the fisheries, after consultation with the local community, relevant regulators and land owners. Advice will be given on the levels of brown trout catches that can be expected and sustained in the future on the basis of the population study described above and the consideration of its results in a wider context through a comparison with equivalent data from other Cumbria lakes. Given the declining water quality, the feasibility and desirability of also developing the lake as a coarse fishery for pike and perch will be assessed on the basis of the above ecological study and wider economic and other considerations (e.g. desired patterns of recreation and tourism in the catchment). Planning for this level of change will be fostered through the LKC as the project develops.

Research Cluster 2*: *Social, institutional and environmental interactions and the creation of new perspectives

2a) Institutional and policy context

Existing institutional arrangements pertaining to agriculture, water resources, environmental protection, spatial planning, economic regeneration, local and regional government, tourism and recreation are all likely to provide both opportunities and constraints for the development of integrated catchment management initiatives. As such, it will be important to generate an understanding of which of the above sectors and policies most affect Loweswater, and how. Drawing on the analysis of Mitchell (1990) the following aspects will be examined:

- Contextual conditions; prevailing economic conditions and ideologies, and governmental arrangements.
- Legitimation; statutes and legislation, levels of political commitment, administrative and bureaucratic policies, and financial resources pertaining to catchment management; the responsibilities, powers and levels of authority of the relevant agencies; and the rules for intervention by higher-level authorities.
- Functions and structures and their distribution; planning, data collection and monitoring, regulation, development, advisory services etc. within the relevant local, regional and national organisational structures.
- Processes and mechanisms: Existing key processes (intra and inter-organisational committees, councils, task forces, partnerships etc) and mechanisms (local and regional spatial plans, environmental and sustainability assessments, economic appraisals etc) will be examined for their current and potential role in assisting/hindering the development of community-based catchment management.
- Organisational cultures and participant attitudes; values, norms, working practices and attitudes will be studied for the effect they may have on catchment initiatives and the incentives and disincentives they create for community involvement in the management of land and water resources.

Research data will be collected using a variety of different methods including:

i. interviews with key representatives for local, regional and national organisations responsible for land and water at Loweswater;
ii. analysis of legislation, government/agency reports, policy documents and other literature;
iii. participant observation at public meetings and events.

Given the nature of the research aims and the data, the analysis will be largely qualitative. Interview transcripts will be coded and analysed using ATLAS Ti computer software. This part of 'Research Cluster 2' will be greatly facilitated by the existence of LKC since members of relevant policy and planning organisations will constitute an important part of the collective, enabling access to grey literature and interviewees.

2b) Local Knowledge

Whilst the research on 'Institutional and policy context' above will concentrate on institutional structures and cultures, it will also be necessary to explore local knowledge that exists about the catchment and about management of land and water

within the catchment. It will be especially important to capture memories of past catchment management practices, as well as to understand the complex interdependencies of social and natural systems and practices in the present.

Interviews will be held with all residents in the catchment – including farmers, and their families, home owners, hoteliers, retirees and any other residents. Interviewers will make every effort to interview a full representation of the different ages, gender, and occupations of those living in the catchment. Interviews will be based around residents' own understandings of and feelings about:

- Living in Loweswater
- Making a livelihood in Loweswater
- Cultures, subcultures and social structures in Loweswater
- Land and lake management
- Management of wastes
- Problems and tensions in the catchment

Building on the approach adopted in the scoping study, interviewers will be guided by ethnomethodological principles (Garfinkel 1967) which suggest that the researcher needs to stay open to interviewees' own frames of meaning, and to avoid imposing forced or preconceived theoretical concepts through over-determined structuring of interview questions. Interviews will be transcribed and analysed using interpretive methods, aided by the software Atlas Ti for the management of data and theory building.

2c) Cross fertilising local, scientific and policy knowledges

The researchers plan that all of the research actions outlined above will take place simultaneously in the first and second years of the project (see 'Programme of Work, below). We also anticipate that emerging results from certain 'research aims' may inform and shape on-going research in others. So, for example, knowledge of the potential economic or environmental disbenefits of a particular kind of land or waste management generated through research in 1a) and 2b) may induce those in the catchment to change their management practices. This in turn may affect monitoring on the aquatic ecological side. Perhaps new measurements (e.g. of water quality, fish densities) may be deemed necessary to ascertain the effects of land-use change or to plan further management changes. A research fund has been set aside for this kind of contingency – see below.

The scoping study showed that local, policy and scientific knowledges can usefully be played off one another in order to identify more clearly the limitations and boundaries of each 'way of seeing' (Geertz 1973) and the potential of working together (Waterton, Norton and Morris forthcoming). Claire Waterton and the full-time RA will have the responsibility of highlighting cross-overs, paradoxes, uncertainties, commonalities and incommensurabilities in local, scientific and policy ways of framing research issues at Loweswater. Such issues are at the crux of interdisciplinary work and raise many philosophical as well as practical questions (Verran 2002). They will be highlighted in LKC meetings and will be discussed fully, facilitated by the researchers.

The LKC will consider ways of innovating creatively with ways of weaving different questions and perspectives together. We anticipate that new research questions will

arise that cannot be catered for within the research clusters already outlined and so we have set aside a budget of £35k. This will enable the LKC to propose projects whose remit or scope extends outside the existing research design with the added benefit of empowering the Loweswater Community to suggest research questions. Proposals for additional projects will be evaluated by the project's Advisory Group to determine whether or not they should be funded and to stipulate the conditions and requirements expected.

Objective 3 – transferability of research

'Insights for transferability' will form a strand of research in its own right within the project and will be explored by the full time RA along with Nigel Watson, Claire Waterton and Lisa Norton. Models of 'social learning' and 'transferability' will be reviewed and analysed from within the literature on UK and international catchment management, science studies, public understanding of science, human geography and environmental/ecological sciences. These models will help to answer the following questions:

- Can lessons from the Loweswater case study be derived and communicated regarding how to enroll local communities, institutional stakeholders and researchers of different disciplines into a common vision and way of working together?
- Which methods and procedures used in Loweswater will be of use to other contexts and other problems?
- Which are not transferable and why?
- How does scale make a difference?
- Is the LKC only relevant to catchment initiatives?
- What other kinds of policy situations might the Loweswater methodologies and mechanisms transfer to?

The researchers will be initiating and attending several meetings and workshops at UK, European and International level (fully documented on Proposal form) that will draw out the transferable lessons of the research. The researchers aim to write one peer-reviewed journal article specifically focussed on the topic of the transferability of the Loweswater research. Lancaster University/CEH researchers (of this and two other RELU proposals) have agreed to design common workshops, to which other relevant (including RELU) researchers will be invited, to be held over the course of the project on 'Transferability across contexts and scales' and 'Interdisciplinarity'.

Analysis

The primary aim of the research is to establish effective methodologies for understanding and acting within Loweswater. The methods of analyses required to achieve this are included within the methods section.

Expected Outputs and Potential Scientific, Practical, Social and Economic Benefits

The research has a practical goal, to try to find ways of understanding and managing land-water-society relationships in Loweswater so as to create a less polluted and

more sustainable natural-social environment. Progress towards meeting this goal will directly benefit many local actors who live and work in Loweswater and those institutional bodies that are working towards sustainable environmental goals in this catchment and beyond.

The research will be a significant early case study for the implementation of the European Water Framework Directive about how to achieve genuine participation in the implementation of EU Directives, and what genuine participation of different knowledge actors implies and demands from those involved.

The research should also be of interest to the growing networks concerned with community catchment management across the globe (e.g. networks such as UNESCO's HELP programme). By putting Science Studies research (on knowledge and expertise) together with Catchment Management perspectives, the research overall offers a critical approach to expertise within practical catchment management issues. In addition to international academic programmes the research should be able to exchange insight on these issues to international NGO's concerned with environment-society relationships and sustainability (e.g. WWF, RSPB). The two major outputs of the work can be summarised as follows;

Output 1
The creation of a transferable institutional mechanism that will enable community- and stakeholder-involved decision making to provide the basis for long term ecological, economic and social sustainability within the catchment. This will be of use to Defra and its constituent organisations (e.g. EA), for non-UK policy and regulatory bodies (e.g. the European Commission), and for other global institutions and bodies exploring the possibilities of stakeholder-rich research design for policy and management.

Output 2
The second output will consist of a successful body of stakeholder-relevant and accessible interdisciplinary research that will form, with other information, a catchment knowledge base that will be available on the internet . This work will incorporate work on

- valuing landscapes
- understanding links between land and water
- institutional and policy context relating to Loweswater
- local knowledge of Loweswater
- decision-support systems for community decision making.

Papers will be written for peer-reviewed journals and for non-specialist audiences (e.g. newsletters, policy magazines, etc.); three small booklets outlining the important findings of the research will be produced and disseminated in both hard copy and on the project web-site (one per year). Seminar and conference papers will be delivered to academic, policy and local audiences. Two workshops will be held, on ‘Transferability across contexts and scales’ and ‘Interdisciplinarity’. The project database and web-site will act as an information node on progress in all these areas of research.

Programme of work
A collaborative research framework has been developed to guide the programme of work and to ensure integration of the various proposed activities. The framework identifies five distinct phases of research, although we recognise that in practice the process is likely to be iterative rather than linear (Gray 1985; Wondellec and Yeffee 2000).

Creating the Loweswater Knowledge Collective (Months 1-7):
Initially, the project will concentrate on the establishment of the LKC, and brokering agreement with potential participants regarding its overall and specific purpose, mode(s) of operation, and membership. The advisory board will be appointed. The field work will be started and the monitoring buoy on the lake deployed. The web-site with the catchment knowledge base will be started.

Problem-setting (Months 5-18):
The project will seek to establish the nature or 'identity' of the problems faced by the Loweswater community. The bulk of the terrestrial ecology and the fish assessment will be undertaken. A call will be made for a new small project(s) and these will be agreed by the advisory board and started towards the end of the period.

Direction-setting (Months 19-24):
Attention will focus on the development and exploration of alternative future scenarios for Lowewater in the light of ecological monitoring, the modelling (which will be largely undertaken in this period), and local knowledge of social, cultural, economic and environmental dynamics.

Structuring (Months 25-30):
The project will concentrate on the design and implementation of practical measures for engaging the LKC and wider community in catchment research and management. This will involve the negotiation of roles and responsibilities and cross-examination of local, scientific and policy knowledge.

Outputs and Outcomes (Months 31-36):
Working with the LKC, the researchers will assess the initial impacts of the project and identify factors or conditions which either facilitated or inhibited effective community involvement in catchment research and management. From this, the potential transferability of this approach to other catchment management situations and other types of environment-society problems will be evaluated. Papers and reports will be written.

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