Environment Agency

using science to create a better place

Addressing environmental inequalities: cumulative environmental impacts

Science report: SC020061/SR4

SCHO0507BMRW-E-P

The Environment Agency is the leading public body protecting and improving the environment in England and Wales.

It's our job to make sure that air, land and water are looked after by everyone in today's society, so that tomorrow's generations inherit a cleaner, healthier world.

Our work includes tackling flooding and pollution incidents, reducing industry's impacts on the environment, cleaning up rivers, coastal waters and contaminated land, and improving wildlife habitats.

This report is the result of research commissioned and funded by the Environment Agency's Science Programme

Published by:
Environment Agency, Rio House, Waterside Drive, Aztec West, Almondsbury, Bristol, BS32 4UD
Tel: 01454 624400 Fax: 01454 624409
www.environment-agency.gov.uk

ISBN: 978-1-84432-765-2 May 2007

Further copies of this report are available from:
The Environment Agency's National Customer Contact Centre by emailing enquiries@environment-agency.gov.uk or by telephoning 08708 506506

Authors:
Carolyn Stephens*, Ruth Willis*, Gordon Walker**

Dissemination Status:
Publicly available / released to all regions

Keywords:
cumulative impacts, inequality, environmental justice

Research Contractor:
**Department of Geography, Lancaster Environment Centre, Lancaster University, LA1 4YB Tel: 01524 594613

Environment Agency's Project Manager:
Helen Chalmers, Social Policy Advisor, Rio House, Bristol

Collaborator(s):
*Public and Environmental Health Research Institute, London School of Hygiene and Tropical Medicine
Institute for Environment and Sustainability Research, Staffordshire University
School of Geography, Earth and Environmental Sciences, University of Birmingham
Department of Sociology, University of Surrey
Policy Studies itute, University of Westminster

Science Project reference:
SC020061/SR4

Product code: SCHO0507BMRW-E-P

Science at the Environment Agency

Science underpins the work of the Environment Agency. It provides an up-to-date understanding of the world about us and helps us to develop monitoring tools and techniques to manage our environment as efficiently and effectively as possible.

The work of the Environment Agency's Science Group is a key ingredient in the partnership between research, policy and operations that enables the Environment Agency to protect and restore our environment.

The science programme focuses on five main areas of activity:

- **Setting the agenda**, by identifying where strategic science can inform our evidence-based policies, advisory and regulatory roles;
- **Funding science**, by supporting programmes, projects and people in response to long-term strategic needs, medium-term policy priorities and shorter-term operational requirements;
- **Managing science**, by ensuring that our programmes and projects are fit for purpose and executed according to international scientific standards;
- **Carrying out science**, by undertaking research – either by contracting it out to research organisations and consultancies or by doing it ourselves;
- **Delivering information, advice, tools and techniques**, by making appropriate products available to our policy and operations staff.

Steve Killeen

Head of Science

Executive Summary

Background

Addressing environmental inequalities is a major theme of the UK Sustainable Development Strategy and one of the three principles of the Environment Agency's social policy. The Sustainable Development Strategy includes a commitment to focus on improving the environment for those areas 'most in need' where multiple dimensions of deprivation and cumulative aspects of environmental impacts exist.

This and other policy drivers provide a strong case for the Environment Agency to progress work on cumulative impacts and how they relate to environmental inequality and deprivation. Understanding more about how environmental impacts accumulate and interact with dimensions of inequality in deprived areas is necessary to develop this policy and to shape interventions, particularly at a local level. Any consideration of cumulative impacts intrinsically cuts across institutional boundaries and will therefore be of relevance to many within and outside government.

Aims

The main aims of this Environment Agency science project were to:

- help the Environment Agency develop an understanding of the cumulative impacts of environmental issues in combination on deprived communities;
- identify ways of assessing the cumulative impacts of environmental inequalities and compare their effectiveness;
- scope and propose an approach to undertaking local case studies that will bring together understanding of cumulative environmental inequalities and ways of addressing them.

Methodology

A rapid review of the literature on cumulative environmental impacts and approaches to assessing these was undertaken. This review was supported by a two-day interactive workshop held with stakeholders from within and outside the Environment Agency. The aims of the workshop were to:

- assist in the review work;
- discuss shared and divergent understandings of core terminology;
- explore perspectives on the scoping of case studies.

Understanding cumulative environmental impacts and inequality

This field of study is at an early stage. There are currently no standard definitions of 'cumulative' or 'multiple' impacts; nor are there standard approaches to their measurement.

There are studies that consider the impacts of environmental conditions on deprived communities either from the perspective of health and/or social impacts. However, most quantitative studies look at individual impacts of the environment and tend to 'control' for the impact of intervening, 'confounding' socio-economic variables.

People who are deprived may also be more vulnerable to the cumulative effects of environmental inequalities than others. Socio-economic, physical and demographic factors associated with deprivation (e.g. language barriers, ability to earn, old age, and health status) often affect people's ability to respond to other pressures, including those caused by environmental degradation.

Much of the work to develop frameworks for evaluating cumulative impacts has taken place in the USA and Canada, partly as a result of community pressures. The US Environmental Protection Agency's approach to evaluating cumulative and multiple impacts has moved from a unitary evaluation of single impacts to a more holistic (if less well defined) approach. This shift has included changes from centralised to participatory approaches in decision-making.

The environmental justice literature is beginning to examine cumulative impacts experienced by communities exposed to environmental inequalities and, most importantly, how these inequalities have come about. In the few studies that exist, both qualitative and quantitative perspectives have been used. Qualitative work helps to identify communities experiencing inequalities and allows community members to vocalise the impacts on their daily lives.

Both the development of frameworks for analysis and greater access to information are important for the reduction of multiple and cumulative impacts on deprived communities. More understanding is needed of the cumulative impacts of policy processes on deprived communities including opportunities for, and constraints on, participation in decision-making.

Assessment of cumulative environmental impacts

Cumulative impacts have been assessed both by governments and by actors from civil society using a range of different methods. The majority of published methodology stems from formal Environmental Impact Assessment (EIA) literature, where the emphasis is on evaluating impacts of proposed changes, usually taking the form of project development.

A report prepared for the Environment Agency in 2004 concluded that cumulative impact assessment is rarely carried out in a formalised or consistent way within EIA. Methods used include expert opinion, checklists, spatial analyses, modelling and cross-sectional epidemiology. Checklists, the most commonly used method, rely on collecting expert opinion and developing simple hypotheses to identify possible cumulative impacts, rather than gathering specific evidence of their existence. There are also problems with the use of linear models for understanding complex cumulative and multiple impacts, as the underlying relationships are frequently synergistic and iterative in nature.

Risk perception studies and lay life-course mapping provide different approaches to assessing cumulative impacts. These emphasise the involvement of local communities in

the assessment process, rather than relying on expert knowledge. For this reason, these methods may be particularly appropriate for use within an environmental justice framework.

Scoping case studies

A number of issues are important when scoping case studies:

- identification of potential issues and problems;
- establishment of conceptual boundaries;
- identification of a site for study;
- establishment of spatial and temporal boundaries;
- identification of past, present and foreseeable future actions;
- identification of ethical issues.

Drawing on examples of case study research and the possible methods and approaches summarised earlier, three potential case study designs were developed.

- participatory cumulative impact assessment guideline development;
- historical case study;
- longitudinal analysis of specific process which may affect environmental inequalities.

Each case study design provides a clearly developed methodology and together they offer a range of potential approaches and project scales.

Each case study would focus on a deprived area, allowing the cumulative impacts of environmental inequalities to be explored in the context of vulnerable communities. A combination of qualitative and quantitative methodologies would be used and each case study design would be amendable to the addition of a comparative element.

Recommendations

There is a supportive political and policy context for taking forward work addressing cumulative environmental impacts. This project recommends that:

- future work on understanding and assessing cumulative and multiple impacts should be developed in an inclusive, participatory way including those on whom these impacts fall;

- initial research which assesses local perceptions and evaluates the effectiveness of area-based initiatives should be undertaken to inform the UK Sustainable Development strategy commitment to focus environmental improvement in areas most in need;

- longer-term exploratory case study research on cumulative environmental impacts and inequalities is also needed. The three potential approaches proposed in this report should be evaluated by a multi-stakeholder group considering issues of definition, scope, policy relevance and ethics;

- as experience with Strategic Environmental Assessment (SEA) develops, an evaluation should be undertaken of how effectively this is operating as a tool for assessing cumulative environmental impacts and for analysing the distributional implications of environmental change.

Contents

1. Introduction

This is one of five reports produced as part of a research project commissioned by the Environment Agency on environmental inequalities in relation to flood risk, waste management, water quality and cumulative impacts. This report focuses on environmental inequalities and cumulative impacts.

This section outlines the context and related objectives of the overall research project. In addition, the policy and research context specifically relevant to environmental inequalities and cumulative impacts is identified, with discussion of report objectives and methodology.

1.1 Context for the research project

The Environment Agency has a wide-ranging role in protecting and improving the environment in the context of achieving sustainable development. It is developing a strong social dimension to its work, recognising that social exclusion can have important environmental dimensions and that all people should have a right of access to a decent environment and to essential environmental resources.

The Environment Agency's social policy is defined through three principles:

- understanding and communicating the social impacts of its work, including opportunities to deliver combined environmental and social benefits;
- addressing environmental inequalities;
- transparency, participation and access to information.

It has also developed a social appraisal framework (Chalmers and Colvin, 2005) which subdivides its social policy into six themes:

- promoting health, safety and well-being;
- improving local communities;
- promoting social justice and social inclusion;
- demonstrating the Environment Agency's corporate social responsibility;
- increasing access to information and participation;
- capacity building and learning.

This project focuses on addressing environmental inequalities. This is one of the Environment Agency's three social policy principles and figures centrally in the promoting 'social justice and social inclusion' theme of its appraisal framework.

In a recent position statement, the Environment Agency makes it clear that tackling environmental inequalities and ensuring access for all people to a good quality environment is critical to sustainable development (Environment Agency 2004). The position statement sets out the role for the Environment Agency in this respect and calls for a series of policy solutions which include 'developing a better understanding of

environmental inequalities and the most effective ways of addressing them'. This position statement builds on a programme of sustained attention given to questions of environmental inequality and social justice within the Environment Agency over the past five years. This has involved working with and responding to the allied agendas of other organisations within and outside government.

Examples of the ways in which the wider political and policy context has evolved over this period include:

- the work of non-governmental organisations (NGOs) such as Friends of the Earth (FoE), which have identified environmental justice as a campaign and research theme, with FoE Scotland in particular making environmental justice an important part of its advocacy work (Dunion 2003):

- a series of pamphlets and publications producing by NGOs, consultancies and political groups highlighting the linkages between the current Labour Government's priorities on social exclusion and the social dimensions of environmental concerns (e.g. Boardman *et al*. 1999, Jacobs 1999, Foley 2004);

- speeches by major political figures such as Jack McConnell, Scotland's first Minister, who in 2002 stated 'For quality of life, closing the gap demands environmental justice too. That is why I said…that environment and social justice would be the themes driving our policies and priorities...' (McConnell 2002) and Tony Blair who argued in 2003 that 'by raising the standards of our local environments overall, we have the greatest impact on the poorest areas' (Blair 2003);

- programmes of work and reports by government departments and agencies exploring the connections between economic, social and environmental policy areas, e.g.
  - the Social Exclusion Unit work on transport and social exclusion (ODPM 2003);
  - the Sustainable Development Commission (2002) focusing on the connections between regeneration, poverty and environment;
  - the Neighbourhood Renewal Unit (NRU) reports on environmental exclusion (Brook Lyndhurst 2004) and achieving environmental equity through neighbourhood renewal (ODPM/NRU 2003);

- the 1998 Aarhus convention (UNECE 1999), a pan-European treaty that aims to give substantive rights to all EU citizens on public access to environmental information, public participation in environmental decision-making and access to justice in environmental matters;

- the new national sustainable development strategy, *Securing the Future* (Defra 2005a), which aims to 'ensure a decent environmental for all' and has clear commitments to address and research environmental inequalities and to 'fairness' in the development of sustainable communities.

Within the Environment Agency, important indicators of policy evolution have included the debate on environmental equality at the 2000 Annual General Meeting and *The urban environment in England and Wales* (Environment Agency 2002a), which provided some initial analysis of relationships between environmental quality and social deprivation.

A research project undertaken by Staffordshire and Leeds Universities for the Environment Agency (Walker *et al.* 2003) explored evidence of inequalities and acted as a stimulus for debate (Chalmers and Colvin 2005) in three key areas of its work – flooding, industrial pollution and air quality. The research provided a literature review, scoping and gap analysis of potential topics for investigation, drawing on the expertise of a range of stakeholders. It provided an empirical analysis of environmental data sets against the Index of Multiple Deprivation (IMD) at ward level (separately for England and Wales) (NAW 2000, ODPM 2004a) identifying varied patterns of inequality. In developing policy and research recommendations for this work, the research team emphasised:

- the need for careful consideration of methodological issues;
- the limits on what the analysis could reasonably conclude;
- the need for further research, including in the area of cumulative impacts.

There is a growing body of related UK-based research examining questions of social distribution and environmental inequality. This was recently reviewed in a Sustainable Development Research Network (SDRN) rapid research and evidence review for the Department for Environment, Food and Rural Affairs (Defra) (Lucas *et al.* 2004a). This review found that the research base is interdisciplinary in nature, drawing on a diverse range of quantitative and qualitative research methods and approaches. The available evidence suggests that patterns of environmental injustice are varied and complex and that there is, therefore, a need for some caution in making claims of inequality and to be wary of over-generalisation.

However, there is mounting evidence that:

- environmental injustice is a real and substantive problem within the UK;
- problems of environmental injustice afflict many of our most deprived communities and socially excluded groups;
- both poor local environmental quality and differential access to environmental goods and services have a detrimental effect on the quality of life experienced by members of those communities and groups;
- in some cases not only are deprived and excluded communities disproportionately exposed to an environmental risk, they are also disproportionately vulnerable to its effects;
- whilst more needs to be known about both the causes and impacts of environmental injustice, research is also needed to support the development and effective implementation of policy measures to address and ameliorate the impacts of environmental injustice.

This project will add to the research and evidence base that already exists in key areas of responsibility for the Environment Agency. It will build directly on previous research and contribute to the commitment to further research made in the Government's sustainable development strategy.

1.2 Overall objectives of the research project

The project aim is to gain a better understanding of environmental inequalities and the most effective ways of addressing them. The project is divided into two discrete parts:

Part 1 will:

- help the Environment Agency to understand the social impacts of waste management, flooding and water quality on deprived communities, and the policy context for addressing these;
- examine the social distribution of waste sites, areas at risk from flooding and river water quality, undertaking where possible analysis for both England as a whole and for each of the English regions;[1]
- make recommendations for the most effective ways of addressing inequalities in relation to waste management, flooding and water quality, for example, by identifying the policy interventions designed to address them with a range of stakeholders and evaluating their relative costs and benefits.

Part 2 will:

- help the Environment Agency to develop an initial understanding of the cumulative impacts of environmental issues in combination on deprived communities;
- identify ways of assessing the cumulative impacts of environmental inequalities, comparing their effectiveness;
- scope and propose an approach to undertaking local case studies that will bring together understanding of cumulative environmental inequalities and ways of addressing them.

1.3 Objectives of cumulative environmental impacts component

This report focuses on understanding cumulative impacts and covers Part 2 of the research project objectives. This part of the project relates less directly to the regulatory and operational functions of the Environment Agency, but has been identified as a key area where:

- understanding is currently limited;
- assessment tools are poorly developed;
- policy has failed to evolve in a very coherent manner.

[1] Wales is excluded from the analysis in this report as the deprivation data currently available is structured differently. A separate report on environmental inequalities in Wales has been produced (Walker *et al* 2006)

Any consideration of cumulative impacts intrinsically cuts across institutional boundaries and the analysis in this section of the report will therefore be of interest and relevance to many different governmental and non-governmental bodies.

The specific objectives for this part of the project are to:

- develop an initial understanding of the cumulative impacts of environmental issues in combination on deprived communities (also expressed in the project brief as 'to understand the cumulative impacts of multiple environmental inequalities/impacts on deprived communities at the local scale');
- identify ways of assessing the cumulative impacts of environmental inequalities, comparing their effectiveness;
- scope and propose an approach to undertaking two local case studies that will bring together understanding of cumulative environmental inequalities and ways of addressing them.

1.4 Summary of methods

Two methods were used in this part of the project.

Rapid literature review
This consisted of a literature search of the following electronic databases:

- ISA Web of Knowledge™ (http://www.isinet.com)
- Medline® (http://medline.cos.com)
- EMBASE (http://www.embase.com)
- PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi)

The following search terms were used alone and in combination:

- environmental justice
- inequalities
- environmental inequalities
- cumulative impacts
- cumulative effects
- multiple impacts
- multiple effects
- environmental impacts
- public health
- population health
- environmental health

- resilience
- vulnerability
- adverse environments
- community participation
- community based participatory research techniques
- environmental impact assessment
- health impact assessment
- strategic environmental assessment.

A manual search of *Environmental Impact Assessment Review* (10 years to present), and electronic searches of UK Government, US Government and European Commission websites were also undertaken.

Stakeholder workshop
A two-day interactive workshop was held in February 2005, with day two focusing on cumulative impacts.[2] The session outcomes are summarised along with presentation materials in Appendix 1.

Participants consisted of members of the project team, the project board and other academics and stakeholders from within and outside of the Agency at national and regional levels. External stakeholders included representatives from:

- Defra
- FoE
- Health Protection Agency
- National Assembly for Wales
- Black Environment Network (BEN).

The purpose of the workshop was to draw on expertise from a range of stakeholders to:

- help ensure that the review work was as complete as possible;
- identify and discuss shared and divergent understandings of core terminology;
- explore perspectives on and ideas for the scoping of case studies.

[2] The workshop was facilitated and documented by Malcolm Eames of the Policy Studies Institute and Karen Lucas of the University of Westminster

2 Definitions and concepts

This section defines and discusses a number of terms and concepts central to the research undertaken in this project. The need to be explicit about meanings and to distinguish between different but related concepts is particularly important in this relatively new and undeveloped area of policy and research.

2.1 Environmental justice

The term 'environmental justice' is open to varying definition and interpretation. Agyeman and Evans (2004) describe it as a 'vocabulary for political opportunity', providing a means of highlighting questions of distribution and procedural fairness across a wide range of environmental policy domains (Stephens *et al.* 2001, Lucas *et al.* 2004a).

Environmental justice has evolved over a 20-year period. It originated in protests against the siting of toxic facilities in minority communities in the USA, becoming part of the 'vocabulary' of environmental debate in the UK over only the past four or five years.

Environmental justice is generally defined in normative terms, specifying a set of conditions or expectations which should be aspired to, sought after or demanded. Two definitions provide examples.

The US Environmental Protection Agency (EPA 1998) defines environmental justice as:

> '… the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including a racial, ethnic, or a socioeconomic group, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies. Meaningful involvement means that: (1) potentially affected community residents have an appropriate opportunity to participate in decisions about a proposed activity that will affect their environment and/or health; (2) the public's contribution can influence the regulatory agency's decision; (3) the concerns of all participants involved will be considered in the decision making process; and (4) the decision makers seek out and facilitate the involvement of those potentially affected.'

The Scottish Executive (2005) defines environmental justice through two statements:

> 'The first is that deprived communities, which may be more vulnerable to the pressures of poor environmental conditions, should not bear a disproportionate burden of negative environmental impacts.
>
> The second is that all communities should have access to the information and to the means to participate in decisions which affect the quality of their local environment.'

Environmental justice has also been conceived in terms of rights and responsibilities. For example, Stephens *et al.* (2001) identify two key assertions of environmental justice as:

> ‘that everyone should have the right and be able to live in a healthy environment, with access to enough environmental resources for a healthy life’
>
> ‘that responsibilities are on this current generation to ensure a healthy environment exists for future generations, and on countries, organisations and individuals in this generation to ensure that development does not create environmental problems or distribute environmental resources in ways which damage other peoples health’.

A number of different elements or interrelated component parts of environmental justice can be identified from the range of definitions that exist.

- **Distributive justice** is concerned with how environmental ‘goods’ (e.g. access to green space) and environmental ‘bads’ (e.g. pollution and risk) are distributed amongst different groups and the fairness or equity of this distribution (see discussion below).

- **Procedural justice** is concerned with the fairness or equity of access to environmental decision-making processes and to rights and recourse in environmental law.

- **Policy justice** is concerned with the principles and outcomes of environmental policy decisions and how these have impacts on different social groups.

- **Intranational justice** is concerned with how these distributions and processes are experienced and operate within a country.

- **International justice** extends the breadth of concerns to include international and global issues such as climate change.

- **Intergenerational justice** encompasses issues of fairness and responsibility between generations, such as emerge in debates over the protection of biodiversity.

Whilst some people may recognise all of these component parts within their working definition or framing of environmental justice, others take a more restricted or focused view. For example, much of the US literature on environmental justice has been concerned primarily with intranational distributive justice, while a recently formed NGO, Coalition on Access to Justice for the Environment (CAJE) (CAJE 2004), in the UK is focusing primarily on issues of procedural justice.

There are also differences in the extent to which environmental justice is seen as only encompassing core environmental issues or extending – within a broader sustainability perspective – to include quality of life and social issues which have environmental dimensions to them (e.g. fuel poverty or access to transport) (Lucas *et al.* 2004a).

While this project focuses on three core environmental topics (waste, water quality and flooding), the case for taking a broader perspective within the work on cumulative environmental impacts is also considered. Although the report primarily examines questions of intranational distribution (within the review work on social impacts and the data analysis), questions of procedure are also raised at various points in each of the reports and connections with wider international issues are identified.

2.2 Environmental inequality

Environmental inequality – the key term used in this project – is in effect a step back from, or component part of, environmental justice.

Inequality is a descriptive term. To observe or claim an environmental inequality is to point out that an aspect of the environment is distributed unevenly amongst different social groups (differentiated by social class, ethnicity, gender, age, location etc.).

There can be different degrees of inequality depending upon how skewed an environmental parameter is towards or away from the social groups of concern. In addition, this can encompass:

- negative aspects of the environment such as exposure to pollution;
- positive aspects such as access to green space;
- procedural aspects such as access to information or decision-making processes.

However, the crucial point is that an inequality is different to an injustice or inequity. It does not necessarily follow that because a distribution of an environmental good or bad is unequal it is also unjust or inequitable. An evaluation or judgement has to be made to progress from inequality to injustice and, as theories of justice make clear, substantially different perspectives can be taken (Young 1994, Liu 2001).

Factors that may be relevant in considering the case for an environmental injustice include:

- the degree of inequality that exists;
- the degree to which individuals have been able to exercise choice in their exposure to an environmental good or bad;
- whether or not an inequality has been created through the exercising of power by a public or private body (e.g. in taking facility siting or flood protection decisions);
- whether or not a pattern of inequality is combined with other patterns of inequality (an accumulation of unequal impacts), or with a higher degree of vulnerability or need amongst a social group, when compared to others;
- the degree to which those exposed to an impact or risk also have a role (direct or indirect) in, or benefit from, its creation.

2.3 Social impact

This project uses the term ‘social impact’ to consider the nature of the relationship between particular aspects of the environment and associated environmental management activities and the impacts these have on humans.

Current definitions of social impact suggest that the concept should be understood in the broadest terms. For example, the International Association for Impact Assessment (IAIA) take the term to cover:

> ‘all impacts on humans and on all the ways in which people and communities interact with their socio-cultural, economic and biophysical surroundings’ (IAIA 2003, p.2).

US guidelines for social impact assessment provide a similarly broad definition:

> ‘By social impacts we mean the consequences to human populations of any public or private actions that alter the ways in which people live, work, play, relate to one another, organise to meet their needs and generally cope as members of society. The term also includes cultural impacts involving changes to the norms, values and beliefs that guide and rationalize their cognition of themselves and their society’ (The Interorganizational Committee on Principles and Guidelines for Social Impact Assessment 2003, p.231).

These definitions highlight the need to go beyond narrow understandings of social impacts as measurable effects upon individuals. Data about social impacts may not be available in a quantifiable form (e.g. information about changes to patterns of social interaction or culture) and consideration should be given to effects upon households and communities as well as individuals. Social impacts may also be direct or indirect, immediate or long term, and both positive and negative in character.

The Environment Agency’s policy appraisal framework (Warburton *et al*. 2005) adopts a broad view of the types of social impacts which need to be included in policy appraisal and is in line with the approach taken in this report.

3 Understanding cumulative environmental impacts and inequality

3.1 Introduction and scope of the review

This section briefly summarises literature on cumulative and multiple impacts of environmental exposures on deprived communities at the local scale. The task was to review this literature in order 'to understand the cumulative impacts of multiple environmental inequalities/impacts on deprived communities at the local scale'.

Despite recent concerns over cumulative and/or multiple environmental exposures, this debate is at an early stage in terms of methodological advances. Currently, there is no standard definition of 'cumulative' or 'multiple' impacts, nor standard approaches to measurement.

Qualitative (mostly risk perception) studies have systematically documented the complex reported interaction of multiple environmental problems that concentrate in disadvantaged areas and communities (Lucas *et al.* 2004a). Yet the main quantitative approaches to environmental and health impact assessment, such as epidemiology, toxicology and environmental science, remain reductionist and look at single rather than cumulative impacts.

Cumulative and multiple impacts can only be understood within a multidisciplinary perspective. However, this rapid review focuses on advances so far which have drawn mostly on conceptual and methodological approaches from mainstream environmental and health science.

The task in this study was to analyse cumulative and multiple impacts in the context of environmental inequality and in the context of deprivation. The review does not cover the literature on inequality extensively, but refers to reviews that have examined this and links this discussion to that on environmental justice.

The review covers mostly conceptual and methodological literature on substantive cumulative or multiple impacts of environmental exposures on deprived communities. However, there are also issues of cumulative impacts of 'procedure' or policy that link intimately to the distribution of environmental problems. These 'procedures' include access to information, participation in decision-making and access to redress. These are not covered extensively but advances are summarised in Section 3.6.

3.2 Defining cumulative and multiple impacts

To develop an understanding of cumulative impacts and environmental inequality, it is useful to first define 'cumulative impacts' in this context. This is complicated by the interchanging use of 'cumulative' and 'multiple' in the literature.

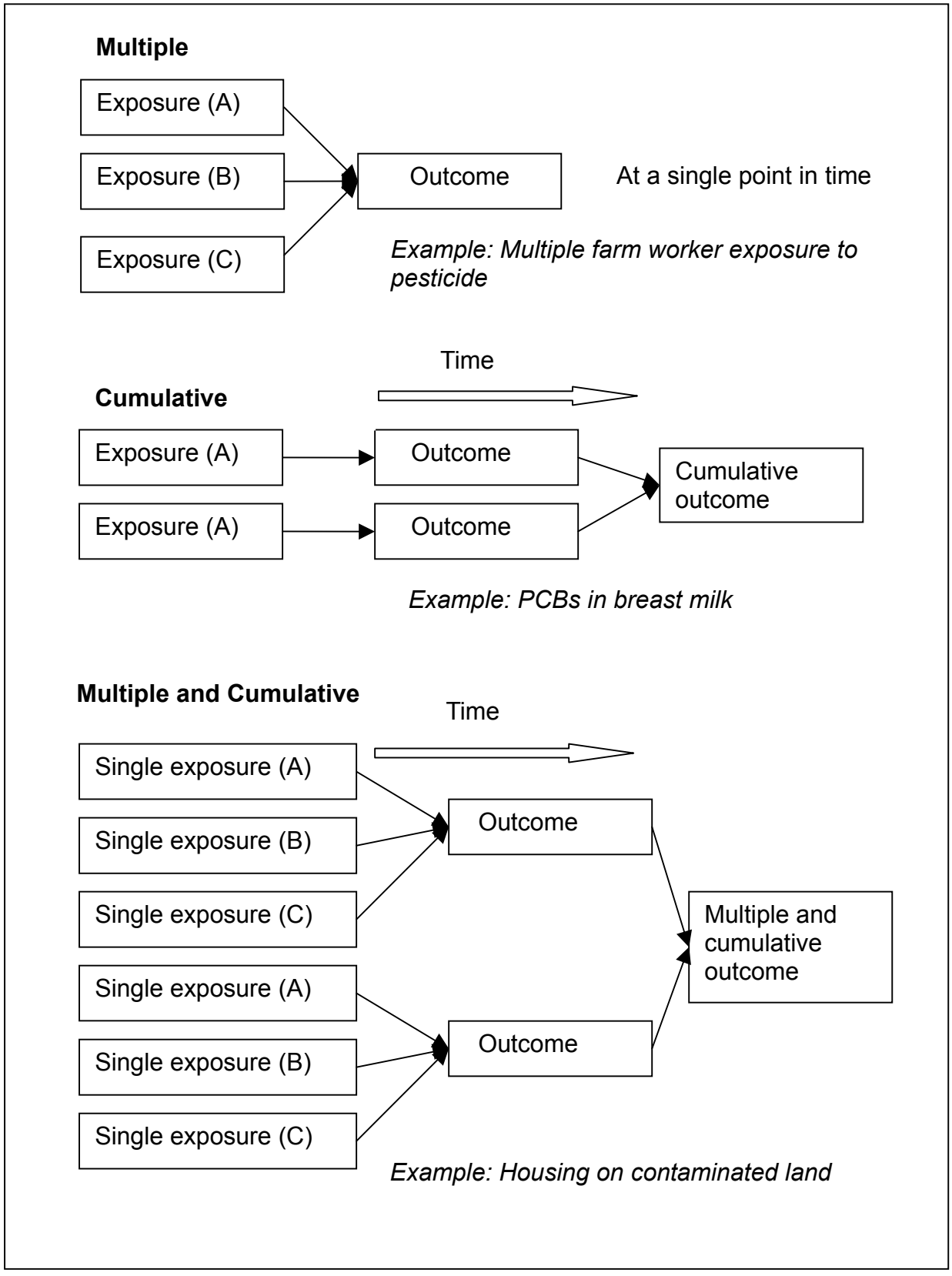
The European Commission *Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions* (European Commission 1999a) introduce the issue with the following statement:

> 'a key problem identified in the study was how to define indirect and cumulative and impact interactions. The definitions of these three types of impact overlap, although there are no agreed and accepted definitions' (European Commission 1999a, p.ii)

Technically, cumulative is defined as 'increasing by successive additions' and multiple as 'consisting of many elements or components' (Chambers English Dictionary, 7th Edition, Schwarz 1988). In the context of impacts of environmental exposures, cumulative impacts therefore refer to a single exposure, repeated many times, while multiple implies more than one exposure, occurring once or repeated many times (cumulative and multiple). These exposures may occur at low levels and only cause noticeable outcomes through their cumulative/multiple effects.

Figure 3.1, which attempts a diagrammatic representation of these definitions, adapts the European Commission's representation of the same issues, but excludes impact interactions (European Commission 1999a p.iii). As with any diagrammatic representation of these concepts, Figure 3.1 suffers from the problem of linearity in defining exactly what constitutes a cumulative or multiple impact. In most real contexts there is interaction of multiple and cumulative exposures. In this representation, however, multiple and cumulative impacts are distinguished most clearly by time. Thus, for example in Figure 3.1, impacts at one moment in time may occur with exposure of a farm worker to multiple pesticides used in the farm setting. This differs from a cumulative impact, e.g. long-term exposure of women to polychlorinated biphenyls (PCBs) in the environment, which then build up in breast milk and can be passed to offspring via breast-feeding. The third example in Figure 3.1 – of multiple and cumulative impacts – occurs where housing is located on, or adjacent to, contaminated land. Multiple exposures may occur from contaminants in the land. If residence in the housing is long term, then these exposures accumulate. If, in addition to this scenario, the housing is of poor quality (e.g. damp) and the residents have access to low quality food and, finally, also live by a busy road, then both multiple and cumulative impacts could be supposed to occur. This report addresses this final scenario. The impacts of these multiple and cumulative exposures are explored in more detail in later sections.

Figure 3.1 Simple representation of cumulative and multiple impacts



A recent review of environmental justice research in the UK (Lucas *et al*. 2004a) outlined one way of looking at cumulative impacts:

> 'The review suggests that environmental problems may accumulate in four ways, namely through: i) spatial concentrations at particular geographical scales and localities; ii) through multiple health impacts; iii) the existence of particularly vulnerable groups (e.g. the very poor, the very young and very old); and, iv) as a result of "knock-on" effects' (Lucas *et al*. 2004a).

This links to the EC guidelines which similarly define 'knock-on effects' as 'indirect effects'. According to these guidelines, indirect impacts are:

> '... impacts on the environment, which are not a direct result of the project, often produced away from or as a result of a complex pathway. Sometimes referred to as second or third level, or secondary impacts' (European Commission 1999a, p.iii).

For example, a new road development through a low-income community may have direct impacts on the community in terms of a potential increase in air pollution and pedestrian road traffic injuries. Depending on the definition of direct and indirect (or knock-on), other impacts may include longer-term community severance, which itself may have impacts on other aspects of the community's well-being.

In the EC guidelines, cumulative impacts are defined as:

> 'impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project' (European Commission 1999a, p.iii).

This proposes a slightly different idea, and in this definition multiple impacts are more akin to interactive impacts.

Since this early development of cumulative assessment theory, several US and Canadian state authorities have developed their own interpretation of terms and approaches. The European Commission study of indirect and cumulative impacts published in 1999 also cites several examples of attempts to develop understanding (European Commission 1999b, European Commission 1999c).

In the UK, both the Environment Agency and English Nature have commissioned reports concerning cumulative impacts which quote the same sources of definition. An Environment Agency unpublished project report (James *et al.* 2003) quotes the EC guidelines (European Commission 1999a) and a practitioner guide prepared for the Canadian Environmental Assessment Agency (CEAA) (Hegmann *et al.* 1999). The latter defines cumulative effects as:

> '… changes to the environment that are caused by an action in combination with other past, present and future human actions' (Hegmann *et al.* 1999).

English Nature's report focusing on the cumulative impact of land development on biodiversity in England also cites the CEAA definition (English Nature 2005).

Most attempts to understand cumulative impacts to date have emerged from environmental science and thus take a different 'chain' of events for analysis – often looking at human impacts on the environment rather than the environment's impacts on humans. However, these studies are highly relevant conceptually, as they grapple with

many of the same issues. For example, the Division of Coastal Management of the North Carolina Department of Environment and Natural Resources (NCDCM) differentiates between two aspects of cumulative impacts and distinguishes them through their different pathways:

> 'Cumulative impacts can be thought of as occurring through two main pathways: first, through persistent additions or losses of the same materials or resource, and second, through the compounding effects as a result of the coming together of two or more effects' (NCDCM 2004).

The NCDCM also distinguishes between cumulative and secondary impacts:

> 'The term 'cumulative impacts or effects' is generally used to describe the phenomenon of changes in the environment that result from numerous human-induced, small-scale alterations. Secondary or indirect impacts are defined as effects that are 'caused by and result from the activity although they are later in time or further removed in distance, but still reasonably foreseeable' (NCDCM 2004).

Its website gives an example from environmental science 'of human-induced environment alterations through their potential direct, indirect, and cumulative impacts' (Table 3.1).

Table 3.1 Direct, indirect and cumulative impacts on watersheds in North Carolina (NCDCM 2004)

Human actions				**Environmental effect and impacts**		
Project/activity		Direct impacts		Indirect impacts		Cumulative impacts
Poorly planned urban development (e.g. roads, residential developments, docks, marinas, bulkheads).	→	Disruption of wildlife habitat.		Increased storm water runoff.		Decline in water quality.
	→	Increased area of impervious surface.		Increased sedimentation of streams.		Decrease in growth rate and size of commercial shellfish.
	→	Loss of wetlands.		Increased freshwater flow into estuary.		Increased shellfish closures.

This model adds indirect impacts and suggests that cumulative impacts derive from the interaction or 'knock-on' effects of direct and indirect impacts. The European Commission (1999a) uses similar concepts and recognises the importance of:

- indirect impacts (see definition above);
- cumulative impacts (see definition above)
- impact interactions

The EC studies give several examples of Environmental Impact Assessments (EIAs) that have covered cumulative and/or indirect impacts. However, in each case study, the reviewers comment on the lack of methodology noting that, for the majority of case studies, 'no specific methodology was described for the assessment of these impact types' (European Commission 1999c, p.35).

The conceptualisation of cumulative and multiple impacts is important in both understanding processes and developing methods for assessment. These concepts must also be understood in the context of deprivation and vulnerability. None of the standard guidelines under development or the examples of work to date address this issue explicitly.

3.3 Defining deprivation in the context of cumulative and multiple impacts

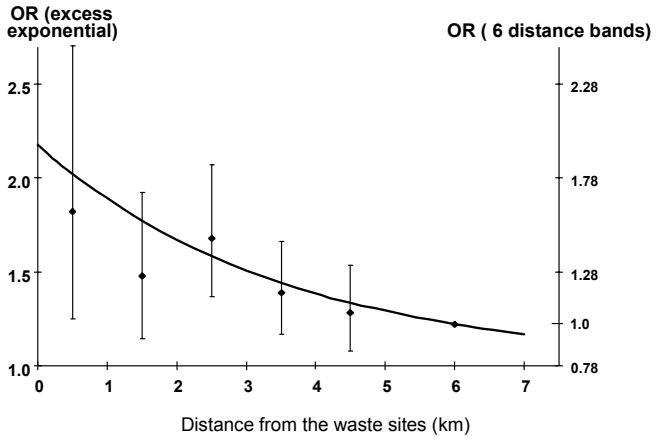
This review focuses on cumulative impacts of environmental inequalities on deprived communities. By definition, deprived communities experience many aspects of disadvantage. For example, the English Index of Multiple Deprivation 2004 (IMD) contains seven domains of deprivation (Social Disadvantage Research Centre 2004):

- income deprivation
- employment deprivation
- health deprivation and disability
- education, skills and training deprivation
- barriers to housing and services
- living environment deprivation
- crime.

The IMD loosely quantifies deprivation and can be used as a comparative tool to identify areas which are most deprived. The 'living environment' section includes measures of housing condition, central heating, air quality and road traffic accidents. This makes the process of understanding cumulative impacts of environmental inequalities on deprived communities somewhat iterative as 'deprived' itself includes some aspects of environmental deprivation.

Many quantitative and qualitative studies look at the impacts of environmental conditions on deprived communities either from the perspective of health and/or social impacts, e.g. Ponizovsky and Perl 1997, Gee 1999, Arcury *et al*. 2000, Perlin *et al.* 2001, Stephens and Bullock 2002, Lucas *et al.* 2004a. However, most quantitative studies attempt to look at individual impacts of the environment and tend to 'control' for the impact of intervening socio-economic variables, regarding these as 'confounding'. Thus, Figure 3.2 shows congenital anomalies in Europe by distance to toxic waste sites. The 'independent' relationship of anomalies to waste site proximity is analysed by controlling all other socio-demographic factors that might influence risk of congenital anomalies (Dolk *et al.* 1998). Thus, 'deprivation' is factored out of the analysis, rather than analysed as a potential multiple or cumulative exposure.

Figure 3.2 Risks of congenital anomalies by distance from toxic waste sites in Europe (Dolk H et al.1998)



Key

OR: Odds Ratio

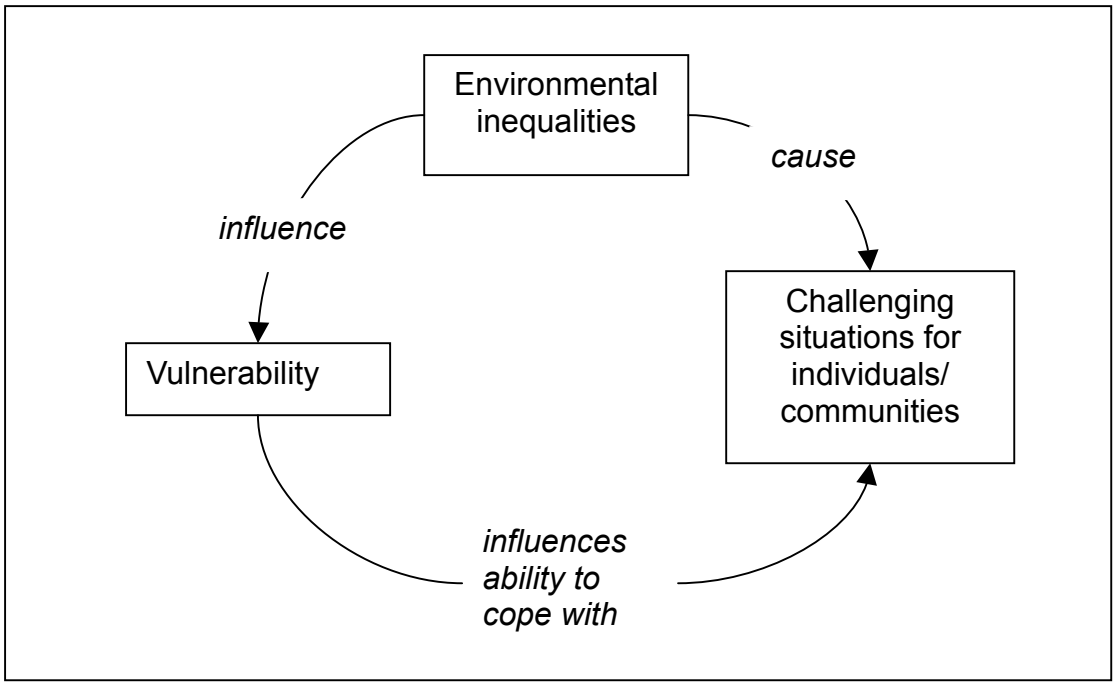
The main group of analysts who have examined environmental impacts in the context of deprivation are those working on environmental justice. This is discussed in Section 3.5, but first it is important to mention another aspect of the population that affects the analysis and understanding of cumulative and multiple impacts.

3.4 Defining vulnerability in the context of cumulative and multiple impacts

Groups defined as 'deprived' may additionally be more vulnerable to cumulative effects of environmental inequalities than others in the community. Socio-economic, physical and demographic factors are often associated with deprivation (e.g. language barriers, ability to earn a living wage, old age and health status). These affect individuals' abilities to respond to difficulty.

Turner *et al.* (2003) propose a framework for vulnerability analysis in which 'vulnerability' is composed of exposure, sensitivity and resilience. Each component of the system is influenced by environmental conditions. 'Sensitivity' is described as particularly linked with the environment, being formed of an interaction between environmental conditions ('natural conditions/biophysical environments') and human conditions ('social/human capital and endowments'). Hence, environmental inequalities are linked to vulnerability both through people's abilities to cope with them and through their contribution to individual vulnerability. These relationships are illustrated in Figure 3.3.

Figure 3.3 Vulnerability and environmental inequalities



This relationship between vulnerability, resilience and cumulative impacts has been described on a larger, parallel scale in the context of ecosystems and biodiversity. Cumulative impacts are recognised as limiting ecosystem resilience over time (English Nature 2005) by reducing biodiversity, which is crucial to maintaining adaptive capacity (Folke *et al.* 2002). Referring to the cumulative impact of land development on terrestrial biodiversity in England, English Nature warns:

> 'if cumulative impacts continue to mount up the ecosystem may pass a critical threshold resulting in the loss of the ecosystem' (English Nature 2005).

A complex systems approach has also been applied in research addressing the 'dynamics of deprivation' in human communities. The ESRC Centre for Analysis of Social Exclusion at the London School of Economics has published a series of reports exploring the inter-relationship between local environment, population socio-economic status, resilience and the impacts of regeneration policy in deprived communities in England and Wales (LSE 2005). These reports identify neighbourhood decline and renewal as crucial themes in the dynamics of low-income areas. These processes were raised in the context of 'cumulative impacts' in the project workshop, with participants identifying pathways of decline and improvement related to the cumulative impacts of an environmental 'bad' on vulnerable groups (see Appendix 1 for detailed examples). Discussion stimulated by the activity raised issues of multiple causal factors and multiple outcomes, non-linear pathways and feedback loops.

Qualitative research with residents in deprived neighbourhoods reveals that they have an implicit understanding of these kinds of connections. Residents commonly speak about these issues as inextricable rather than distinguishing between social, environmental and economic problems. A recurrent example is the way in which the lack of work and activities for young people may lead to anti-social activities that affect the safety and amenity of the local environment. These may, in turn, contribute to the stigmatisation of

the neighbourhood and heighten feelings of frustration and powerlessness (Burningham and Thrush 2001, Lucas *et al*. 2004b).

This emphasises the importance of a complex system's approach incorporating vulnerability and resilience to the consideration of cumulative impacts.

3.5 Cumulative impacts, environmental inequalities and justice

This section summarises literature on the understanding of cumulative impacts in the context of environmental inequality and deprivation.

Inequalities in the UK have been studied extensively by both social scientists and epidemiologists.

- The 1998 Acheson report summarised over 700 studies on health inequalities in the UK related to a range of environmental and social conditions, including housing quality, fuel poverty, transport and food poverty (Acheson *et al.* 1998).

- The phrase 'environmental inequalities' is a particular construction used in some UK discourse and links to the wider debate on inequality in the UK. For example, the Environment Agency's position statement, *Addressing environmental inequalities*, describes environmental inequalities as follows:

  > 'the quality of the environment can vary between different areas and communities ... People who are socially and economically disadvantaged often live in the worst environment'(Environment Agency 2004).

- Similarly, the UK sustainable development strategy consultation document lists examples in which people living in deprived communities experience the worst air pollution, the most pedestrian deaths from road accidents and least access to legal advice and support. It states that:

  > 'it is widely recognised that inequalities like these can affect peoples' health, safety, sense of community and even local job opportunities. Tackling these environmental inequalities can therefore help improve quality of life overall' (Defra 2004).

The concept of 'cumulative impacts' of environmental inequalities has developed from an awareness that individual environmental factors rarely act in isolation (European Commission 1999a, Cutter *et al.* 2002). The environmental justice movement recognises that people who live in deprived communities are likely to be exposed to the negative impacts of environmental inequalities to a greater extent than people who do not live in deprived communities. These have been studied individually:

- in this project with respect to waste management, flooding and water quality;
- elsewhere with respect to traffic and transport, housing quality, access to green space.

The concept of environmental inequality is frequently blurred with that of environmental justice. The environmental justice research community has carried out the most work on

the impacts of the environment on socially disadvantaged and deprived communities; for over 20 years in the USA and over the last 5–10 years in the UK, e.g. Bullard and Wright 1993, Coughlin 1996, Scandrett *et al*. 2000, Stephens and Bullock 2000, Agyeman and Evans 2004, Lucas *et al*. 2004a, Walker *et al.* 2005. By 2003, the USEPA had begun piloting new methods of risk assessment to apply to multiple and cumulative environmental exposures following criticisms from environmental justice groups of the routine methods used to assess such risks (Science Policy Council 1997)

Arguably, some environmental 'bads' are unavoidable. To provide transport links, roads are necessary and as long as large numbers of people drive motor vehicles, these will generate chemical pollution and noise. Some communities, however, experience a disproportionate burden; situated along a motorway corridor, on contaminated land, beside polluting industrial sites. These sites of 'environmental injustice' (which, as discussed in Section 2, is different from inequality) can also be described as suffering from 'cumulative impacts' of environmental inequalities.

Intrinsically, therefore, examples of environmental injustice are frequently cases of 'cumulative impacts of environmental inequalities'. In the UK, a good example is provided by transport policy and impacts on disadvantaged children. Thus, for example, rates of pedestrian road traffic injuries (RTIs) for children in social class 5 are five times higher than for children in social class 1 (Acheson *et al.* 1998). This can be, and has been, described as an inequality (Acheson *et al.* 1998). To some, this in itself is an injustice. However, arguably this inequality becomes an injustice when evidence shows that these children are from low income families, themselves without motor vehicles and living by busy roads often used by higher income people (Stephens *et al.* 1998, Stephens *et al.* 1999).

Cumulative impacts analysis tends to look primarily at substantive negative impacts on the environment or on humans. Much environmental justice work has focused similarly on substantive negative impacts. In this context, cumulative exposure means that individuals and communities – often the least economically powerful – experience the environment as a complex of harmful exposures both at one time and over time.

Thus, evidence in the USA and UK shows that poorer communities are more likely to

- live near hazardous waste sites and busy roads;
- have poor quality housing;
- have limited access to transport or affordable and uncontaminated food and water.

These exposures may often combine with more hazardous employment and lower incomes for families.

These cumulative exposures can link to long-term illnesses, which in turn affects family incomes and perpetuates a cycle of environmental and social injustice (Coughlin 1996, Acheson *et al.* 1998, Wing *et al.* 2000).

However, as discussed in Section 2, it is possible to identify different types of environmental injustice. Table 3.2 distinguishes between four types (Stephens and Bullock 2002, Lucas *et al.* 2004a, Walker *et al.* 2005):

- the distribution of exposure to environmental impacts (distributive justice for costs);

- the distribution of access to environmental resources (distributive justice for benefits);
- the differential ability of different groups to influence decisions affecting the environment (procedural justice);
- whether policies have a distributional impact (policy justice).

Table 3.2 Potential scales and types of environmental injustice (Stephens and Bullock 2002)

Scale	Types of existing environmental injustices			
	Exposure to environmental costs	**Access to environmental benefits**	**Participation in decision making**	**Inequitable policies**
National (UK)	Pollution from industry located in mainly poorer areas.	Low use of national parks by ethnic minorities.	Lack of third party rights on planning decisions.	Flood defence allocation based on value of property.
International	Mining in developing countries for developed country consumption.	Limited access to healthy foods for the farmers who supply most of the supermarkets of the North.	Overrepresentation of Western governments on bodies such as the WTO.	Valuation techniques which value people's lives differently – USA versus developing countries.
Intergenerational	Production of bioaccumulative persistent chemicals.	No access to the consumer goods for those who experience the disbenefits of overconsumption	Failure to use precautionary approaches for chemicals policy.	Risk assessment models which do not take into account extra vulnerability of embryos.

Table 3.2 outlines the potential overall scale of environmental justice. This report does not cover the cumulative impacts of environmental inequalities on deprived peoples internationally, though this is arguably substantial and of a much greater scale than local impacts within the UK. An example of this is the cumulative impacts of climate change largely driven by consumption in the northern hemisphere on the ecosystems of the southern hemisphere.

Another aspect, which should be mentioned in the context of both vulnerability and deprivation, is the cumulative impact of environmental inequalities on children and future generations. Children from poorer countries and of poorer families within wealthier countries experience less healthy living, ambient and learning environments (Gee 1999). Children go on to experience reinforcement of this cycle in their adulthood, with less access to remunerated, secure and rewarding employment. There is a further issue highlighted by recent work in the USA; this cycle links to a cumulative exposure to environmental risks by children in poorer communities (Corborn 2000, Evans and Kantrowitz 2002, Faber and Krieg 2002). On the basis of this evidence, a number of authors argue for the inclusion of both international and intergenerational impacts in

assessment models (Williams 1998, Powell and Stewart 2001, Stephens and Bullock 2002, Agyeman and Evans 2004).

Table 3.2 highlights another aspect of cumulative impacts, which although not discussed in depth in this report, is important. Policies as well as impacts can also be 'unjust'. Substantive injustices are caused, in part, by procedural injustices. For example, waste disposal policies are not designed to hurt poorer communities but can do so through the decision-making process if wealthier groups can access and influence decisions more easily and avoid perceived harm.

Box 3.1 gives an example of discussion around this issue. Another example is provided by the experience of the residents of Greengairs – a relatively poor community in Scotland. In 1998, they found that a landfill operator was accepting toxic PCB waste from an affiliated site in Hertfordshire, England – a comparatively richer area. Disposal of this waste in landfill sites was illegal in England, but regulations were less strict in Scotland. Local campaigning brought an end to the imports of PCB waste and also secured other environmental and safety improvements (Scandrett *et al*. 2000). However, inadequate enforcement of regulations, derisory fines and poor identification of pollution levels remain major national problems (McBride 1999).

Box 3.1 The procedural injustices that lead to substantive environmental injustice

'When you say that it (incineration) is acceptable, it is acceptable to the more articulate sections of the population. From what you have said, the incinerator ends up in the less articulate sections of society. I do think we ought to make that quite clear.'

Lord Judd questioning Richard Mills of the UK National Society for Clean Air and Environmental Protection (Ryder 1999).

As emphasised earlier, the UK is at a very early stage in its development of cumulative impact understanding and assessment. It is therefore important to consider all possible aspects of the scope of UK cumulative impacts assessment. An environmental justice lens on cumulative impacts might include an analysis of policy impacts, as well perhaps as international and intergenerational impacts. The next section discusses the frameworks that have been used to date to assess cumulative impacts and reviews current frameworks for their potential to assess such impacts.

3.6 Frameworks for understanding the cumulative impacts of environmental inequalities

Most development of frameworks for actual understanding of how to evaluate cumulative impacts has taken place in the USA and Canada – partly as a result of community pressures on science and government. Table 3.3 outlines the USEPA transition in assessment ideas related to cumulative and multiple impacts from more unitary evaluation of single impacts to a more holistic (if less well defined) approach. (Science Policy Council 1997)

Table 3.3 Transition in USEPA risk assessment characteristics

Old	New
Single end-point	Multiple end-points
Single source	Multiple sources
Single pathway	Multiple pathways
Single route of exposure	Multiple routes of exposure
Central decision-making	Community-based decision-making
Command and control	Flexibility in achieving goals
One size fits all response	Case-specific responses
Single media-focused	Multi-media focused
Single stressor risk reduction	Holistic reduction of risk

Unlike European trends in understanding of cumulative impacts, the USEPA includes changes in its approaches to decision-making, alongside, and as part of, the shift from single pathway, single source, to more 'holistic' ways of understanding environmental risks. Thus, the USEPA not only moves from single to multiple end-points in analysis of risk, but also from central to participatory decision-making. According to the USEPA, this transition is not an easy one:

> 'This evolution has occurred at an uneven pace, propelled at times by the public and by Congressional concern about environmental risks and their cumulative effects; and, it has been restrained in some cases by statutory authority or limitations of technical knowledge, data and resources' (Science Policy Council 1997).

Despite the ambition of the USEPA's description of its shifts, existing US frameworks for understanding cumulative impacts originate largely from fairly narrow EIA and SEA methodologies. These were developed mainly in the US political context and are used to screen proposed actions for their potential to cause or contribute to negative impacts on the environment (Wood *et al.* 1997).

The US Science Policy Council first started to develop guidance on how to understand cumulative impacts in 1997 (Science Policy Council 1997). This was very much built on the concepts and methods of EIA and proposed a new framework known as Cumulative Environmental Assessment (CEA). Table 3.4 summarises this evolution from EIA to CEA.

Table 3.4 Incorporating principles of cumulative effects (CEA) into the components of environmental impact assessment (EIA)

EIA components	CEA components
Scoping	• Include past, present and future actions • Include all federal, non federal and private actions • Focus on each affected resource, ecosystem and human community • Focus on truly meaningful effects
Describing the affected environment	• Focus on each affected resource, ecosystem and human community • Use natural boundaries
Determining the environmental consequences	• Address additive, countervailing, and synergistic effects • Look beyond the life of the action • Address the sustainability of resources, ecosystem and human communities

Some consideration of 'cumulative effects' in EIA has been required in the UK since the EC EIA Directive (85/337/EEC) was implemented in 1988. However, a review by Cooper and Sheate (2002) of 50 Environmental Impact Statements produced between 1989 and 2000 concluded that cumulative effects were 'far from thoroughly addressed'. Box 3.2 summarises current legal requirements for SEA in the UK. Generally, it would be fair to say that actual methods of assessment are way behind the directives requiring these new ways of working and analysing impacts on the environment.

Box 3.2 Statutory requirements for considering cumulative impacts in SEA in the UK

The Environmental Assessment of Plans and Programmes Regulations 2004, SI 2004 1633, require an assessment to be made of the environmental impact of plans or programmes initiated on or after 21 July 2004. Schedule 2 Paragraph 6 of the Regulations include specific consideration of cumulative effects:

'The likely significant effects on the environment, including short, medium and long-term effects, permanent and temporary effects, positive and negative effects, and secondary, cumulative and synergistic effects, on issues such as –

(a) biodiversity;
(b) population;
(c) human health;
(d) fauna;
(e) flora;
(f) soil;
(g) water;
(h) air;
(i) climatic factors;
(j) material assets;
(k) cultural heritage, including architectural and archaeological heritage;
(l) landscape; and
(m) the inter-relationship between the issues referred to in sub-paragraphs (a) to (l).'

The Countryside Agency, English Heritage, English Nature and the Environment Agency are specified in the Regulations as 'consultation bodies' that must be consulted both 'when deciding on the scope and level of detail of the information' required in the assessment report and to review the completed report.

The UK's draft practical guide to SEA (ODPM 2004b) states that each environment report should include information on:

> '... the likely significant effects on the environment, including on issues such as biodiversity, population, human health, fauna, soil, water, climactic factors, material assets, cultural heritage, … these effects should include secondary, cumulative, synergistic, short, medium and long term, permanent and temporary, positive and negative effects' (ODPM 2004b).

The more complicated issue is the methods to be used to achieve this ambitious evaluation.

Using an environmental justice framework, attention is focused on the cumulative impacts experienced by communities exposed to environmental inequalities and, most importantly, how these inequalities have come about (Roberts 2000, Simon 2000, Faber and Krieg 2002, Fox 2002, O'Fallon and Dearry 2002, Krieg and Faber 2004).

In terms of 'addressing environmental inequalities', identifying and understanding these cumulative impacts can provide tools to avoid and reduce future or current environmental inequalities. But this necessitates a different focus on exposures and outcomes from

traditional EIA orientation. 'Upstream' factors in policy-making need to be considered and new methods developed to describe and measure outcomes. Emphasis shifts to analysis of past actions and the current situation as well as screening future proposals.

In the existing environmental justice framework, both qualitative and quantitative perspectives have been used to explore the cumulative impacts of environmental inequalities. Qualitative work helps to identify communities experiencing inequalities and allows community members to vocalise the impacts of inequalities on their daily lives (see Box 3.3).

Box 3.3 Qualitative representation of environmental inqualities

"They've got it all," stated an NGO environmental justice worker, describing a community on England's north-east coast. "Industrial pollution, houses falling apart, unemployment from collieries closing down, incinerators, water pollution, a nuclear power station, traffic pollution… for this community, cumulative impacts are multiple barriers to change."

Quantitative methods are important to measure exposures and outcomes such as:

- volume of contaminants;
- proportion of households with poor housing;
- physical health outcomes;
- economic impacts.

This allows greater comparability between sites.

Environmental justice literature is gradually beginning to address this issue. In the USA, where forms of 'cumulative impact assessment' are legally required to be included in EIA, Kreig and Faber (2004) proposed a methodology for a 'Cumulative Environmental Justice Impact Assessment'. In the UK, the SDRN environmental justice review noted the importance of considering 'Multiple Environmental Deprivation (Cumulative Impacts)' and drew attention to the lack of UK-based analysis (Lucas *et al.* 2004a).

Both the development of new frameworks for the analysis of cumulative impacts and the development of greater access to information are important for the reduction of multiple and cumulative impacts on deprived communities. Section 4 looks briefly at existing assessment methods and their value for understanding of cumulative and multiple impacts of environmental inequality.

4 Assessment of cumulative environmental impacts

4.1 Existing UK tools and their potential for distributional and cumulative assessment

Cumulative impacts have been assessed in the UK using a range of different methods, both formally by governments and by a range of actors from civil society. The majority of published methodology stems from formal Environmental Impact Assessment literature where the emphasis is on evaluating impacts of proposed changes, usually taking the form of project development.

In the UK, Cumulative Effects Assessment (CEA) is defined in a report commissioned by the Environment Agency as:

'An assessment of the incremental effects of an action on the environment when the effects are combined with those of past, existing and future actions' (James *et al.* 2003).

However, the report concluded that:

'CEA is considered as part of the assessment of some plans and programmes but it is not done in a formalised or consistent way' (James *et al.* 2003).

Table 4.1 lists methods used within EIA and summarises their advantages and disadvantages for the analysis of cumulative impacts of environmental inequalities on deprived communities. This shows how heavily these methods rely on checklists, which essentially return to hypotheses about cumulative impacts rather than giving any evidence of their existence. Almost all of the examples used in the EC commissioned study of indirect and cumulative impacts (European Commission 1999b, European Commission 1999c) either give no information on the methods used to assess cumulative impacts or suggest that expert opinion, modelling and checklists were the main methods.

Many of the methods discussed in Table 4.1 give only a vague idea of the real existence of impacts. Thus, the Office of the Deputy Prime Minister (ODPM) gives the example of a table for recording cumulative impacts that relies entirely on the 'expert' judgment of the environmental consultant employed to undertake the assessment (ODPM 2004b, ODPM 2004c).

Table 4.1 Methods used in EIA and their advantages and disadvantages for the analysis of cumulative impacts

Method	Description	Advantages	Disadvantages	Quantification	Examples
Expert opinion	Consultation with recognised 'experts' in the field – experienced practitioners, academics – to identify and assess effects.	Simplicity, cost. Useful when other methods are not possible but cumulative effects are considered to be likely.	Possibility of bias Accreditation may be difficult. May affect transparency and acceptability of assessment process.	No	USDA Forest Service/USDI BLM 1994 Expert opinion required to assess the probability of ensuring the viability of a species – Northern Spotted Owl.
Questionnaires, consultations, interviews	Used to gather information about actions and possible receptors of cumulative effects in the past, present and future. May include brainstorming sessions, consultation with local communities and knowledgeable individuals.	Possibility of broad, representative views. Able to include subjective information. Personal interests of affected individuals can be taken into account.	Cost Identifying relevant stakeholders Possibility of non-representative participation.	No	European Commission 1999a Fox *et al.* 2002 So-called 'verbal argumentative' sessions and analysis in the identification of likely cumulative and/or indirect impacts. Undertaken in Finland and Lapland for assessment of power plants and their impacts.
Checklists: questionnaire checklist, impact interaction checklists	Producing a list of all possible effects and ticking those that may be relevant.	Systematic and simple Can be relatively low cost. Can be carried out by assessment team/ experts/ community. Possible to develop standard checklists for use in similar projects.	Risk not quantified Not definite May not include all possible effects.	No	Canter and Kramath 1995
Causal chain/network analysis	Production of flow charts showing possible chains of effect and interaction. Allows tracing of indirect	Visual display of conceptually complex relationships can	Difficult to incorporate spatial/temporal scale. May become overly	No	Brismar 2004

Method	Description	Advantages	Disadvantages	Quantification	Examples
	effects.	aid understanding.	complex.		
Spatial analysis	Use of overlay mapping, routine data and geographical information systems (GIS) to identify where cumulative impacts may occur and who/what may be affected.	Clear visual presentation, inclusion of spatial component. Can cover different timescales. Easily updated.	Time-consuming Cost	Partly – can use quantitative data, with comparative outcomes.	Mennis 2002 Maantay 2002
Matrices	A tabular format combining options from a checklist.	Provides a visual summary of impacts. Matrix components can be weighted and output values ranked.	Validation may be difficult. Including many factors may result in interpretation difficulties.	Yes, but can be difficult to estimate true risks/effects.	NRC 1996 Matrix-based screening: Matrix 1 – 40 types of biophysical effects, 12 socio-cultural-economic effects of project; Matrix 2 – presence of 26 other common types of actions and interaction of their effects with Matrix 1.
Indices	A numerical combination of two or more factors to form a single value.	Provides a single summary of impacts. Components can be weighted.	Validation may be difficult. Including many factors may result in interpretation difficulties/lack of sensitivity.	Yes	Faber and Kreig 2002 Development of a composite measure to compare the overall risks characteristic of each community.
Trends analysis	Describes the status of a resource, ecosystem or human community over time – often producing a projection of past or future conditions.	Addresses accumulations over time and helps to identify effects.	Requires a lot of data/ Extrapolation and interpretation quite subjective.	Yes, but can be difficult to estimate true risks/effects.	Environmental Health Surveillance System for Scotland (EHS3) operated by the Scottish Centre for Infection and Environmental Health (SCIEH); http://www.show.scot.nhs.uk/scieh/ (now part of Health Protection Scotland)
Carrying capacity and threshold	Based on ecological principles of carrying	Takes into account fragility of the	Difficulty in identifying/	Yes, but can be difficult to estimate true	Army Corps of Engineers 1991 Impacts of boat traffic on the

Method	Description	Advantages	Disadvantages	Quantification	Examples
analysis	capacity and ecosystem thresholds.	environment. Compares predicted impacts to capacity of system.	quantifying carrying capacity/ threshold points of systems.	risks/effects.	carrying capacity of aquatic life by setting a threshold for the water clarity needed for vegetation growth.
Modelling	Using quantitative data to construct an abstract representation of the relationship between system components under different conditions. The model may vary in complexity from simply including several variables to representing a complex natural system.	Addresses causal relationships. Can include spatial and temporal factors. Adaptable to include new variables.	Relies on accurate quantification of inputs. Can require large volume of data. Extrapolation and interpretation quite subjective, relying on experts. Validation may be difficult.	Yes, but can be difficult to estimate true risks/effects.	FERC 1988 Modelling spillage and aeration caused by adding turbines to additional dams in succession to determine effect on dissolved oxygen levels.
Environmental epidemiology: one exposure over time	Using quantitative data to investigate association between single exposure repeated over time and human health.	Investigates and quantifies association. Possible to control for known confounders.	Unknown confounders, colinearity	Yes	Weisglas-Kuperus *et al.* 2004
Epidemiology: cross-sectional study, multiple exposures	Using quantitative data to investigate association between cumulative environmental risk exposures and human health.	Investigates and quantifies association. Possible to control for known confounders.	Risk of 'ecological fallacy' – unknown confounders, colinearity	Yes	Evans and Marcynyszyn 2004

4.2 Other methods used in the UK to assess cumulative impacts

In addition to these formally recognised methods, it is also useful to consider additional methods and perspectives from other disciplines, which may complement the environmental justice framework. These are summarised in Table 4.2.

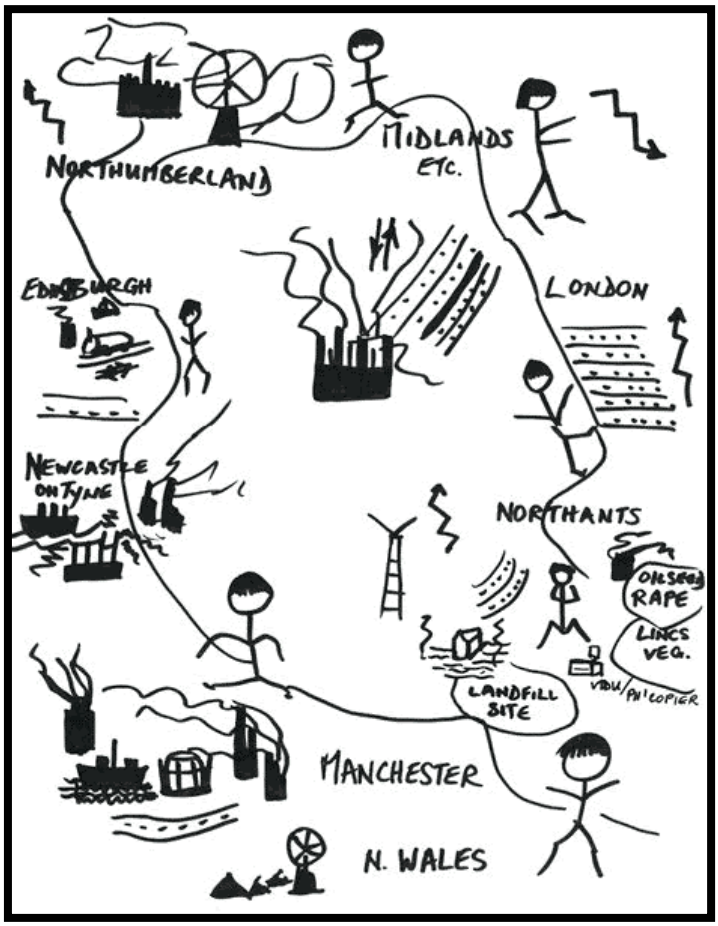
These perspectives emphasise the importance of community involvement in assessing cumulative impacts in contrast to the expert-led EIA methods above. This highlights the issues of ownership and motivation:

- Who requests an assessment to be carried out?
- Who will influence assessment requirements and methodology?

From an environmental justice perspective, redressing inequalities and avoiding future creation of inequalities is key. The methods appropriate to achieve this will differ from those used by a company planning a new venture.

An excellent example of such an approach was developed by the UK Women's Environment Network (WEN). The project asked women with breast cancer throughout the UK to map their lifetime exposures (WEN 1999). Figure 4.1 shows a map from a participant in Newcastle.

Figure 4.1 Mapping risks for breast cancer, Newcastle (WEN 1999)



The approach used by WEN has parallels with the latest methods of epidemiology in which a 'life course' approach is used to understand health impacts of environmental and social exposures. The approach has gradually developed as a key way to understand health inequalities (Davey-Smith and Ebrahim 2001).

Table 4.2 at the end of this section summarises advantages and disadvantages of these alternative approaches.

4.3 Review conclusions

This rapid review has summarised some of the features of the changing debate on the understanding and assessment of cumulative and multiple impacts in the context of environmental inequality and deprivation in the UK. It has looked at the general understanding of cumulative and multiple impacts to date and discussed this in the context of understanding on inequality, environmental justice and deprivation.

Within the context of this project, a workshop was held in February 2005 in part to discuss cumulative impacts (see Appendix 1). Many of the issues raised by participants in this workshop are reflected in the literature. In terms of understanding, these include:

- a lack of conceptual clarity in defining cumulative and multiple impacts;
- a similar lack of clarity in defining inequality, inequity and injustice;
- the potential circularity of discussion and analysis when cumulative impacts are discussed and analysed in the context of 'deprivation';
- the lack of a standard definition of cumulative or multiple impacts;
- the majority of development of understanding of cumulative impacts has come from North America and Europe;
- most of the work on cumulative impacts has been done from the perspective of environmental science and by environmental justice researchers;
- most cumulative impact understanding deals with substantive impacts, but there is some move towards more understanding of the cumulative impacts of policy processes (e.g. access to information, participation in decision-making).

In terms of assessment frameworks, the following conclusions flow from the review and, to an extent, the workshop results.

- Assessment tools and frameworks generally lag behind the advances made in policy towards cumulative impact evaluation.
- There is a problem with using linear models to understand complex cumulative and multiple impacts, which are probably synergistic and iterative in nature.
- There is a problem with assessment models to date, which have dealt with cumulative impacts only through a checklist and modelling approach.
- There is a paucity of real examples of analysis where more than checklists and modelling are used.
- Qualitative studies have reported complex multiple impacts of environmental conditions on deprived communities, but quantitative approaches rarely move beyond checklists.

- While policy frameworks have been developed that may allow more analysis of cumulative impacts of policy processes (such as access to information), this is a very recent move in the UK and there are no examples to date.

Table 4.2 Cumulative impacts of environmental inequalities: alternative methods and approaches

Perspective	Description	Advantages (if relevant)	Disadvantages (if relevant)	Example
Vulnerability	Vulnerability factor (via psychosocial stress) suggested linking social conditions and environmental hazards in disadvantaged populations.			Gee and Payne-Sturges 2004
Risk perception studies	Proposing a shift from risk to exposure assessment to enable environmental managers to respond to environmental justice critiques.			Corburn 2002a
Community run studies	Environmental justice movement/NGOs challenging expert-driven scientific research by taking research process into their own hands.	Credibility in local community Community ownership	Lack of funding security	Corburn 2002b
Community projects	Indirectly targeting cumulative impacts of environmental inequalities – assessment via monitoring improvements rather than cataloguing problems.	Community ownership Credibility Sustainability	Lack of funding security May rely on dynamic individuals remaining involved	CSV Environment 2002
Lay life-course mapping	Individuals drawing life-map of locations, activities and possible exposure to environmental hazards.	Individual agency and interpretation Inclusion of long timescale Alert to possible exposures	Not quantifiable Difficult to verify Possible inclusion of irrelevant/false postulated associations	WEN 1999

5 Scoping case studies

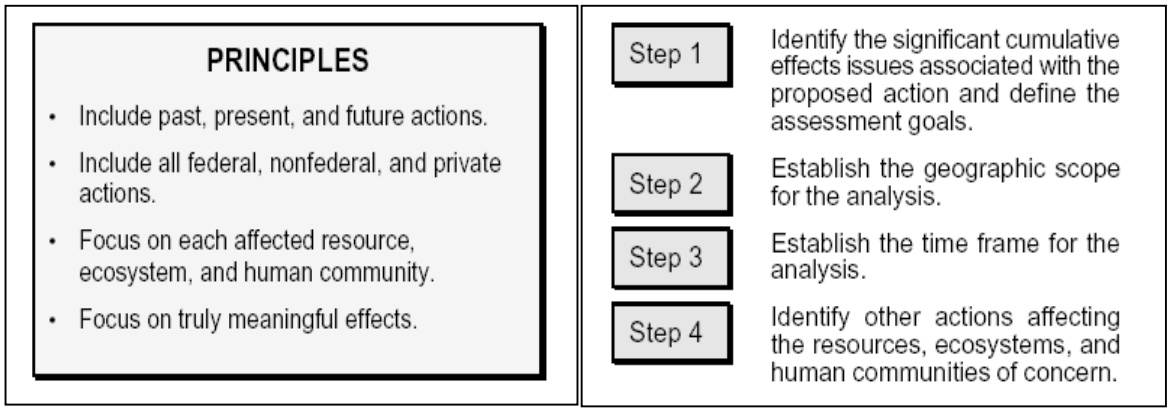
5.1 Conceptual background

Scoping is a common exercise in the development of most impact assessments, including social, environmental and health impact assessments (European Commission 1999a, IAIA 2003, James *et al.* 2003, Mindell and Joffe 2003). Most authors agree that scoping has two main purposes. It is an important exercise for any final assessment as it identifies appropriate boundaries and issues of concern on which to focus. Scoping is also important as a stage to limit the range of issues addressed by the final assessment.

Within the initial scoping stage of an impact assessment, there are several logical steps which are useful to define the scope of the final assessment. In many impact assessments, these scoping activities are relatively straightforward and involve a clearly defined set of checklists. In most scoping exercises, there is a specific project for which the impact assessment is planned and the scoping fits into an overall project context.

As discussed in Section 3.6, methodology for assessing cumulative environmental impacts is further advanced in the USA and Canada than in Europe. The US Council on Environmental Quality produced guidance in 1997 for CEA, including a section about 'scoping for cumulative effects'. A summary of the main principles and steps identified in this document is given in Figure 5.1.

Figure 5.1 Main principles and steps in cumulative impact assessment (Council on Environmental Quality 1997)



These broad guidelines raise a number of important conceptual issues such as definition and measurement (already discussed in Sections 3 and 4). Scoping for cumulative effects analysis is summarised as 'a proactive and iterative process'. The guidelines provide a general framework for scoping but do not offer guidance about possible methods to 'identify significant cumulative effects' and potentially cover a vast area of information, which is not usefully restricted by the principle 'focus on truly meaningful effects'.

Assessment of cumulative impacts is at preliminary stages in the UK. Guidelines for EIA scoping projects produced by the Environment Agency make brief reference to cumulative impacts and raise some broadly applicable issues (Environment Agency

2002c). In common with US literature, the guidelines emphasise the importance of involving stakeholders at early stages and developing an iterative process.

The only direct reference made to cumulative impacts in these guidelines is in an evaluation of the use of prompt lists in scoping, with a specific statement that this is not an appropriate method for addressing cumulative impacts (see Table 5.1).

Table 5.1 Advantages and limitations of using prompt lists for scoping ((Environment Agency 2002c)

Advantages	Limitations
Good for identifying a wide range of issues to be considered.	May be used too mechanically – if it is not on the list, it is not considered.
Useful for inexperienced staff.	Do not indicate significance.
Help to ensure a systematic approach.	Do not consider the location of the development and site-specific details.
Help to ensure a consistent approach	*Cannot address cumulative or indirect impacts.*

In the context of this exploratory project and as discussed in Section 3, the complexity of scoping cumulative impacts is linked directly to conceptual definitions of cumulative or multiple impacts.

How one defines ‘cumulative’ and/or ‘multiple’ affects all the boundaries to be defined in an assessment. At the scoping stage, ideally, the boundaries (e.g. temporal and spatial) of an assessment would be defined. The Environment Agency study of cumulative effects assessment and the SEA directive (James *et al.* 2003) identifies five tasks that need to be undertaken when scoping for a cumulative impact assessment. These are:

- identification of potential issues and problems;
- selection of valued environmental and community resources and future objectives;
- establishment of spatial boundaries;
- establishment of temporal boundaries;
- identification of past, present and reasonably foreseeable future actions.

This project is scoping for an approach that will give a better understanding of cumulative impacts of environmental inequalities on deprived communities. In this context, it is also important to scope for an approach that would be the most ethical and valuable for the local communities involved. Thus for the purpose of this study, the most important issues in a scoping exercise are:

- identification of potential issues and problems;
- establishment of conceptual boundaries;
- identification of a site for study;
- establishment of spatial boundaries;
- establishment of temporal boundaries;

- identification of boundaries of past, present and reasonably foreseeable future actions;
- identification of ethical issues related to case study sites.

These are discussed briefly in turn below.

5.1.1 Identification of potential issues and problems

Perhaps the greatest challenge at the scoping stage for an assessment of cumulative impacts is the definition of exactly what is meant by the term 'cumulative'. A checklist approach might serve to identify which issues are important (James *et al.* 2003). However, as the workshop groups in this project demonstrated, how 'cumulative' is defined alters how 'important' issues are identified by a checklist approach. Since the UK has not yet adopted a standard definition of cumulative impacts, this led one workshop group to suggest that the first stage of an assessment process might be to undertake case studies of how 'cumulative' is defined by different communities.

5.1.2 Establishment of conceptual boundaries

This refers as much to the limits of a definition of 'environment' as to the limits of definition of 'cumulative'. In the context of studies of environmental impacts on 'deprived' communities, a number of basic questions should drive the scoping of conceptual boundaries for a detailed assessment.

- How are 'impacts' defined? Are social and health impacts to be included alongside more strictly environmental impacts?
- How is cumulative/multiple defined? Does the UK accept any one of the current usages of the terms?
- How is 'deprived' defined? How does this link to other aspects of vulnerability?
- Are both positive and negative cumulative processes to be considered?
- What role does the community under study have in the definition of all these conceptual boundaries?

These questions possibly form the most basic issues in the scoping exercise for this project. Some of these issues were discussed in the project workshop (see Appendix 1).

The complexity of defining conceptual boundaries in the area of cumulative impacts of the environment on deprived communities in the UK has never been addressed before. The workshop groups in this project used many different conceptual frameworks for thinking about cumulative impacts, environment and deprived communities. This reflected, in part, the disciplinary training of the participants.

A missing element in the workshops was the presence of representatives of communities with experiential understanding of environmental impacts (and potentially, cumulative impacts). There is, potentially, a strong argument that the most realistic way to develop case studies in the context of this exploratory study of cumulative impacts is to identify potential sites on the basis of willingness of local stakeholders – most importantly local communities – to be involved. Following this, a detailed case study would first involve a scoping exercise to define these conceptual boundaries.

5.1.3 Identification of a site for study

In most scoping exercises this is not a stage that needs to be considered since most scoping is done in the context of a defined project on the ground. In the context of this project a basic step is defining the criteria for selection of a site. This is discussed in more depth in the following sections. However, overall issues for site selection fall into three broad themes:

- **Conceptually led**
  - Should the case study site provide examples of impacts within the overall thematic concerns of this report – flooding, waste, water – or cover broader issues, e.g. a port or floodplain site where industrial contamination may combine with flooding?
  - Should the case study site be selected on the basis of past evidence of multiple environmental exposures, e.g. a major industrial site?
  - Should the case study site be selected on the basis of a proposed complex intervention, e.g. Olympic plans for London?
  - Should there be more than one case study to allow for comparison between deprived and affluent areas in order to assess how processes of change and accumulation vary between these?

- **Policy led**
  - Should the case study site selection be based on existence of an intervention in an area where an intervention is planned or ongoing, e.g. in an area where a complex, intersectoral intervention such as regeneration is underway?
  - Should the case study be in a site where the local community have shown an interest and willingness to host such a study, e.g. where the Environment Agency has been working with local communities in Pathfinder projects?
  - Should case study selection be based on local government willingness to be involved in policy follow-up?

- **Data led**
  - Should the case study site selection be driven by availability of data, e.g. where Environment Agency staff have already undertaken EIAs and identified potential cumulative impacts or where a Local Air Quality Management designation provides for high quality data on pollution sources and concentrations?
  - Should the site be selected on the basis of the potential to derive quantitative evidence of cumulative impacts, e.g. data from small areas will not always provide sufficient statistical power for analysis?

These site selection criteria can overlap, but they may also be in conflict. Data-driven selection of a site may lead to an analysis of what is possible to understand within existing data collection systems or primary data collection. It would then be important to be clear whether a case study would aim to generate quantitative results, or a qualitative understanding of how communities perceive cumulative impacts. Policy-driven selection of a site may lead to a site where policy change is possible, but where data for analysis are weaker.

The selection of sites for the study of cumulative impacts may try to combine many of these criteria and involve a pragmatic site selection based on local ownership. Once this decision is made, the other tasks within scoping become simpler.

Alternative case study options are described in Section 5.3. Possible ways forward are based, in part, on workshop results, but also on examples of different approaches from the literature reviewed in Section 2.

5.1.4 Establishment of spatial boundaries

In the contexts of most assessments, this is a relatively simple exercise of drawing the geographic limits of the overall assessment. The setting of spatial boundaries:

> 'involves finding a balance between the constraints of time, budget and data availability, and the need to adequately address environmental effects that could extend for considerable distances away and into the future' (James *et al.* 2003).

In the context of this project, a spatial boundary for the assessment of cumulative impacts cannot easily be defined in the absence of an actual selection of a site. However, general issues emerge which are related, once again, to how 'cumulative', 'environment' and 'deprived' have been defined.

5.1.5 Establishment of temporal boundaries

Understanding cumulative impacts of the environment on deprived communities can imply an analysis of effects in combination at one point in time if 'cumulative' has been defined in this way (i.e. as a combination of impacts of many exposures at one point in time). However, if time is implicit in the definition of 'cumulative' then temporal boundaries for analysis need to be set.

In the context of the last century of social history of the UK, economically deprived communities have traditionally been located in industrial areas in poor housing, and often in port areas and on floodplains. This implies an extensive history of environmental exposures, many of which have been studied, but usually in isolation and not in combination.

How far back in time and how far ahead in time an assessment will go will depend – but only in part – on the site selection strategy. For example, even if a site is selected on the basis of a proposed intervention, some existing impacts will reflect long-term past exposures. The setting of temporal boundaries needs to be addressed at the start-up stage of the case study.

5.1.6 Identification of boundaries of past, present and reasonably foreseeable future actions

Identifying temporal boundaries raises issues of time frames, which need to be considered whether or not a proposed intervention is being studied. Similar boundary issues arise for the identification of boundaries of past, present and reasonably foreseeable future actions in the context of cumulative impacts. This is particularly relevant in the context of policy-led case studies of proposed or planned complex interventions.

James *et al.* (2003) argue that past and present impacts of actions are easier to identify, though they may be empirically hard to evaluate. The evaluation of 'reasonably foreseeable' impacts is more difficult. They propose a way of classifying future actions, which is most relevant in a case study of a proposed intervention:

- **Hypothetically** – there is considerable uncertainty whether the intervention will take place;
- **Reasonably foreseeable** – the action may proceed, but there is some uncertainty;
- **Certain** – the intervention will proceed.

In the context of the case studies of impacts of the environment on deprived communities, this scoping issue is of most relevance for case studies of proposed interventions such as regeneration in areas of deprivation.

5.1.7 Identification of ethical issues related to case study sites

One of the central issues of site selection and overall case study scoping is the identification of ethical issues related to the case studies. This is particularly important in the context of this exploratory project (the first of its kind in the UK) to look at the impacts of environmental inequalities on deprived communities.

Workshop members were aware of the risk of further stigmatising deprived communities by labelling sites as suffering from cumulative environmental impacts. Concerns were also raised about adding to communities' existing fears about the quality of their environment without offering any solutions.

Ensuring meaningful processes and outcomes for communities as well as project stakeholders is an extremely important issue to be considered in the selection of study sites and case study methodology. This accords with the procedural and participatory principles of both EIA processes (Hartley and Wood 2005) and environmental justice, as enshrined in the Aarhus Convention (UNECE 1998). This provides an opportunity for cumulative effects assessment methods to be developed incorporating a strong component of participatory methodology and actively promoting environmental justice.

Identification and consideration of ethical issues were prioritised in the case study scoping process and are discussed below.

5.2 Examples of recent cumulative impact projects

In order to inform the project's scoping of proposals for future case study work, two recent projects were identified as examples of different approaches to assessing cumulative impacts. The first, carried out by English Nature, is a single area-based study of the cumulative impacts of development on biodiversity (English Nature 2005). The second is based on work carried out at the Centre for Social Exclusion (CASE) at the London School of Economics, which synthesises the results of a six-year study in 12 deprived communities (Paskell and Power 2005).

Tables 5.2 and 5.3 highlight the main features of the two example research projects. Each table is followed by a discussion of the strengths and weaknesses of the project approaches in the context of environmental justice.

Table 5.2 Project example 1: The cumulative impacts of development on biodiversity in England (English Nature 2005)

Study design	Longitudinal case study of development and its cumulative impacts in Thames Basin Heaths Special Protection Area.
Location type	Heathland area in Berkshire, Hampshire and Surrey in south east England.
Spatial and temporal boundaries	Spatial: ecological boundary of heathland, covering 8,400 ha and defined as a Special Protection Area under EC Directive 79/409 on the Conservation of Wild Birds. Temporal: between 1904 and proposed housing allocation to 2016.
Possible policy stakeholders	Local and national government
Relevance to policy development	Relevant to policy concerning development, including housing and transport
Components and methods	Review of current plans and policies covering: • the heath; • existing flora and fauna species and their status; • historical description of development expansion in the area over the 20th century and its impact on habitat loss • mapping of future developments and their likely cumulative impacts on biodiversity.
Methods/tools	Desk-based review using existing data Consultation workshop.
Ethical issues	Potential conflict of interest between development/environment arms of the government.

This study had several major strengths:

- Ecosystem approach – attempting to consider all aspects of the ecosystem, from detailed mapping of insect movement pathways to analysis of proposed government housing policy. This approach provides a potentially valuable component to bring to a case study of cumulative environmental impacts in human communities.

- Specific policy targeting – the study was initiated as the first stage of a process examining 'the cumulative effects of current and foreseeable development on terrestrial biodiversity in England' (English Nature 2005) and, as such, its outputs are specifically targeted with relevance to development policy in England.

However to have most impact in an environmental justice framework, the study would need to include:

- distributive analysis of the human populations affected directly by proposed developments and by the longer-term effects of proposed developments;

- participation by affected communities in scoping and carrying out the case study;

- possibly, a comparative element with a parallel case study site in a deprived region of the country.

Table 5.3 Project example 2: housing, environment and regeneration policy in deprived areas in England and Wales (Paskell and Power 2005)

Study design	Six-year longitudinal study monitoring the effects of government housing, environment and regeneration policy in 12 low-income areas.
Location type	12 low-income representative areas in England and Wales
Spatial and temporal boundaries	Spatial: local authority area, within the 3 per cent of wards in England and Wales among both the 5 per cent poorest (using a 'work poverty' measure based on 1991 Census data) and the 5 per cent most deprived (using the Breadline Britain Index). Temporal: six-year longitudinal study
Possible policy stakeholders	National and local government
Relevance to policy development	Providing evaluation of the impact of existing national government policy and local strategies on housing, environment and regeneration policy.
Components and methods	Quantitative and qualitative data from 12 CASE low-income study areas collected through fieldwork and from statutory agencies. This included interviews with residents, housing staff, community workers, 2001 Census data and local authority housing statistics. Policy: review of national government housing, environment and regeneration policy, and local authority regeneration strategies.
Methods/tools	Qualitative: interviews Quantitative: routine data analysis. Desk-based policy review.
Ethical issues	Possibility of further stigmatising areas? Evaluating and documenting improvement in some cases – positive outcome

The main strengths of this approach are:

- detailed qualitative and quantitative data covering a six-year time span in 12 areas providing a sound basis for analysis;
- the focus on deprived areas enables analysis based on potentially the most vulnerable groups in society;
- the study directly monitors the effects of local and national policy in the 12 study areas and, as such, is well placed to provide evidence to shape future policy.

In the context of environmental justice, this study would benefit from:

- the inclusion of an additional strand focused on identifying the cumulative impacts of policy decisions in each study area;
- specific consideration of environmental inequality and policies to addresses it.

This study demonstrates how closely the effects of policy can be monitored in communities. It provides a methodology that could potentially be applied to the monitoring of the effects of policy in addressing environmental inequalities.

5.3 Proposed case study designs

Drawing on the discussion of these two case study examples and the possible methods and approaches summarised earlier, three potential case study designs were developed from ideas proposed during the project workshop.

During the workshop, discussions among different groups of participants focused around some of the same themes that are commonly explored in the international cumulative impact assessment literature. These included:

- the identification of the temporal and spatial boundaries of the case study location/s (Council on Environmental Quality 1997, James *et al.* 2003);

- the importance of using participatory methods (Kearney 2004, Hartley and Wood 2005);

- the challenge of identifying boundaries of data collection while trying to cover all foreseeable effects. The Environment Agency commissioned SEA/CEA review notes:

    > 'there is further complexity when assessing cumulative effects because it is important to avoid assessing more than necessary. This can be difficult because the scope of a CEA can be very wide' (James *et al.* 2003).

Workshop participants also discussed the ethical implications of carrying out case studies in situations where research may have a detrimental effect on the community involved. This consideration is not evident in the reviewed literature but is explored in Section 5.1.7.

Three case studies discussed during the workshop were later selected for development (Table 5.4). These were chosen as they provided the most clearly developed methodology and a range of approaches and project scales.

Table 5.4 Three proposed case study designs

	Study design	Scale
1	Participatory cumulative impact assessment guideline development	Small–medium: 12–18 month time span >£100,000 funding commitment
2	Historical case study	Medium: 2–3 year time span >£200,000 funding commitment
3	Longitudinal analysis of specific process which may effect environmental inequalities	Large: 10 year time span >£500,000 funding commitment

5.3.1 Common themes

The three case study proposals share several common themes.

- Each case study focuses on a deprived area, allowing the cumulative impacts of environmental inequalities to be explored in the context of vulnerable communities (see Section 3.4).

- A combination of qualitative and quantitative methodologies is proposed for each case study to create a rich and diverse evidence base. This was emphasised as a necessary feature by participants in the project workshop, while recognising the complexities involved in combining and integrating different sources of data ('expert' and lay, measured, monitored and perceived).

- Should resources allow, each case study design would be amendable to the addition of a comparative element, e.g. in urban/rural settings or under different national policies in England and Scotland. This would introduce some additional complications such as selecting 'comparable' areas (although one alternatives discussed by workshop participants was to compare a deprived with an affluent area), but may be desirable given sufficient resources.

Detailed descriptions and discussion of each of the three alternative case study designs are provided below.

5.3.2 Case study design 1: participatory cumulative environmental impact assessment guideline development

Study design	Participatory cumulative environmental impact assessment guideline development
Location type	Housing estate built on former industrial site
Spatial and temporal boundaries	Spatial: geographical boundaries of estate Temporal: retrospective longitudinal study of the former land use prior to housing, with a focus on the last five years
Scale	Small–medium (see Table 5.4).
Possible policy stakeholders	• Environment Agency • Defra • Local authority – environment, health
Relevance to policy development	• Recent implementation of the Aarhus Convention requires public access to information, justice in environmental matters and effective public participation in decision-making. • The 2005 UK Sustainable Development Strategy states 'this Government has a clear vision that within 10–20 years no-one should be seriously disadvantaged because of where they live' and proposes the development of measures of 'social justice' and 'environmental equality' to facilitate this (Defra 2005). • This project would develop new policy guidelines for CEA within the Aarhus Convention framework with direct relevance to the UK Sustainable Development Strategy.
Components and methods	• Interviews with local residents, local authorities, legal advisors and researchers involved in investigating recent situation • Conceptual mapping of 'cumulative impacts' • Review of policy driving past decisions • Independent assessment of current environmental situation • Involvement of local stakeholders from the initial stages • Involvement of community members in analysis and report production.
Methods/tools	• Qualitative: individual interviews and workshops. Involvement of local residents in guideline development and presentation. • Quantitative: assessment of current situation, use of GIS modelling.
Ethical issues	• No guarantee of direct benefit for specific community involved, beyond capacity building through participation. • Not investigating any new issues, so avoiding bringing additional stigma to an already stigmatised area. • Producing positive outcomes – opportunity for others to learn from past problems and avoid in future. • Capacity building: developing community members' skills. • Avoids studying a group/community solely for theoretical purposes.

Discussion

This is the smallest of the three proposed case studies on both temporal and financial scales. The proposed case study location is a housing estate built on former industrial land, the residents of which have already experienced substantial exposure to both the cumulative impacts of environmental inequalities and local government approaches to tackling these issues.

A participatory approach from initial scoping onwards would allow people with direct experience of cumulative impacts of environmental inequalities to be involved in all stages of the project. It would also fulfil the requirements of the Aarhus Convention and may provide a model for the effective incorporation of public participation in other forms of impact assessment.

The project would be specifically focused towards producing UK guidelines for carrying out CEA, with inclusion of an environmental justice perspective rather than simply extending EIA techniques.

In addition, participatory workshops would provide an opportunity for discussion of 'cumulative impacts' beyond academic and government circles, allowing input from affected communities to develop a consensual definition.

Conceptual mapping with local residents would explore an ecosystem approach to identify networks of relationships between policy, environmental inequalities and other aspects of community life.

This project would not promise substantial changes to the everyday lives of people involved. This would be made clear at the outset – the community would be approached with a request for their involvement to develop guidelines for best practice to benefit other communities in the future rather than change their own current situation. However, benefits for individual participants and the community as a whole would be envisaged in terms of skills training and capacity building through close involvement in the case study.

This case study provides an opportunity to contribute substantially to policy while making minimum compromise in ethical considerations. Because the case study site has already been identified as having multiple environmental problems, the proposed research project would not be expected to introduce additional stigmatisation to the area.

The end-product of guideline development adds meaning to the project for those involved, avoiding a situation where a group is studied solely for theoretical purposes.

5.3.3 Case study design 2: historical case study

Study design	Historical case study
Location type	Former industrial area, such as a port or former colliery town, undergoing social, economic and environmental change
Spatial and temporal boundaries	Spatial: geographical boundary of former industrial area Temporal: approximately 100 years, spanning the early 20th century to the present
Scale	Medium (see Table 5.4).
Possible policy stakeholders	• Environment Agency • Local authority – environment, leisure and health • Local Agenda 21 • English Heritage • National Trust
Relevance to policy development	Provide general evidence for policy development.
Components and methods	• Interviews with local residents • Consultation of council records of land ownership and land use • Archive newspaper reports and photographs
Methods/tools	• Qualitative – interviews • Quantitative – GIS • Hand searching of archives
Ethical issues	• Value to local residents – will this change anything? Possible stigma to area from reminding community of past contamination, etc. • Possible benefits to community in providing information • Ownership by local community • Capacity building.

Discussion

This case study would apply a historical perspective to develop an understanding of the policy, economic and social conditions and decisions that contributed to social, economic and environmental change in the locality.

Participatory methods would be used to involve community members with 'ownership' of the project, collating both official and personal records of the area over the previous century. This may provide material for local publications, schools or museum displays.

Again, the project would not promise to change people's local conditions but would provide evidence for local and national policy-makers to identify positive and negative aspects of processes of change to guide future policy decisions.

Consideration of ethical issues raises the question of the value of the project to the local community. Benefits such as community ownership of the project and the production of resources for local schools and community displays must be balanced with the possibility of detrimental effects arising from formally documenting negative processes of change in

a specific area. This balance will be determined by local conditions in different communities and could be discussed during scoping consultation processes.

5.3.4 Case study design 3: prospective case study of a specific event

Study design	Longitudinal analysis of specific process that may affect environmental inequalities, e.g. (a) London 2012 Olympic bid, (b) managed coastal retreat.
Location type	Local area, e.g. London local authority areas directly affected by the Olympic bid, coastal town local authority area.
Spatial and temporal boundaries	Spatial: local authority/s boundary Temporal: prospective longitudinal study: (a) for all or part of the time period to 2012 (also monitoring longer term effects post-2012 if possible) (b) for time period to completion of retreat (also monitoring longer term effects if possible)
Scale	Medium–large (see Table 5.4)
Possible policy stakeholders	• Local authority(s) • Environment Agency
Relevance to policy development	• Opportunity to work with local authorities to develop and monitor sustainable community strategy, Local Development Network/Neighbourhood Parish Plans. • Evidence of good/bad practice to guide future local policy
Components and methods	• Integrative framework for a number of approaches including: – routine data analysis; – mapping flows and networks in and out of the area; – qualitative participatory research – diary lifestyle studies. • Involvement of local stakeholders from initial stages.
Methods/tools	• Qualitative – interviews and focus groups, diary study • Quantitative – routine data analysis, GIS mapping
Ethical issues	• Danger of consultation fatigue and the 'usual suspects' • Action research and the extent to which communities are studied/involved in research • Whether the research helps to change things. • Importance of not imposing researcher's values when seeking community opinion. • Payment of people involved – at all, who, how much? • Long timescale facilitates constructive involvement with community.

Discussion
This longitudinal case study is the largest scale of the three proposed study designs. Building on strengths described in the housing environment and regeneration project example (see Table 5.3), the case study would follow a community over a 5–10 year period spanning the build-up to a specific event and its aftermath. This would offer an opportunity to monitor both immediate and longer-term effects of policy decisions on people's experiences of the impacts of environmental inequalities.

Basing a case study around a specific event such as the London 2012 Olympic bid or managed coastal retreat would create a ‘natural experiment’ with a substantial fieldwork element running either continuously or through regular cross-sectional studies. It would also facilitate substantial involvement of both project stakeholders and affected communities. The long timescale would enable meaningful engagement with the local community, avoiding a situation where researchers work closely with a community for short time and then disappear, leading to community disillusionment with research projects.

During initial stages of the study, researchers would contact local stakeholders and community leaders to discuss any history of consultative projects in the area and ensure that the community was not suffering from ‘research fatigue’ and that it supported the aims of the project.

The long timescale of this study and ensuing substantial time commitments of participants may also raise the issue of payment. The research team would need to consider whether they felt it was necessary and/or appropriate to offer payment to participants to compensate them for their time and ensure long-term commitment to the project. These considerations would need to be balanced with the potential implications of paying participants, including whether receiving payment from a government agency could compromise their status as community representatives.

The feasibility of securing long-term funding for the project would also be an important concern. Funding to span the lifetime of the project would need to be guaranteed from the outset to enable long-term planning.

Assuming these issues were resolved, this study design would provide possibilities to develop valuable insights into short- and longer-term cumulative effects of policy decisions. The project would develop communication pathways allowing communities’ experiences to directly inform both research analysis and local and national policy.

6 Recommendations

Consideration of cumulative and multiple impacts is at an early stage in research, policy and practice. There are fundamental questions of what these terms mean and how they are to be assessed in the context of deprivation and inequality, which remain unclear and in need of discussion and deliberation. It is not therefore straightforward to move towards policy prescriptions. It is also premature to attempt to identify which policy tools would be most effective in assessing or addressing cumulative environmental impacts.

There are two areas in which policy measures are beginning to incorporate consideration of cumulative and multiple impacts. As discussed in Section 4, the SEA Directive provides a means by which decisions about future plans, programmes and policies might take account of cumulative and multiple impacts, and also of distributional inequality issues (though the latter are not high profile in SEA guidance; Walker *et al*. 2005). There is, however, a long step from the expectations in guidance on SEA to their realisation in practice, and SEA is concerned essentially with future change rather than with past and current processes and situations.

The other area where existing policy has arguably taken on board multiple environmental problems is in regeneration initiatives that have sought to improve neighbourhoods in a holistic and multidimensional manner. Here a focus on local lived experience and the quality of the immediate door-step environment has, without involving assessment processes, begun to address the fact that different aspects of environmental quality and local well-being are interconnected. However, regeneration initiatives have rarely attempted to address a wide range of environmental problems simultaneously – particularly those extending beyond 'door-step' issues – and are not appropriate in themselves for coherently or systematically considering how impacts might be cumulative and interact with deprivation.

Within this limited policy context to date, there are a number of questions which need to be addressed in order to develop a future policy agenda on cumulative environmental impacts.

- To what extent do environmental factors interact with the social and economic dimensions of deprivation to exacerbate processes of decline in deprived areas and to constrain the success of regeneration and renewal projects?

- How do communities perceive cumulative impacts and environmental inequalities at a local level?

- How do communities evaluate interactions and linkages between different types of local problem and processes of change?

- What lessons can be learnt from the delivery of area-based approaches to tackling inequalities at a local level including, for example, Pathfinder projects and the work of Local Strategic Partnerships?

- What basket of measures and approaches is most effective in tackling cumulative environmental impacts?

- How can approaches to participatory assessment of cumulative impacts be developed which take account of the needs of different stakeholders affected by these impacts?

- How can multiple actors and local service providers work together to tackle poor environmental quality and its impacts on multiple deprivation?

- How effectively can existing environmental assessment tools be adapted for the analysis of cumulative impacts and the analysis of the distribution of impacts across social groups? Alternatively, should new assessment tools be developed which are more custom-built for these tasks?

There are both general and specific opportunities for addressing these questions and taking forward the policy agenda.

First, there is a supportive general context for developing understanding of cumulative and multiple impacts in an inclusive, participatory way, building on models from civil society groups and involving those on whom these impacts fall. There is a burgeoning environmental justice movement, supported by non-governmental and academic groups, and new legislation which should bring greater access to information for all groups in society. As the USEPA has learnt, the participatory approach does not provide the easiest route, but it is one which avoids leaning on technocratic tools that currently do not offer understanding.

Secondly, and more specifically, the new UK Sustainable Development Strategy (Defra 2005) emphasises the importance of addressing environmental inequalities and includes a commitment to focus on improving the environment for those areas 'most in need'. The strategy recognises that a comprehensive system for identifying 'most in need' areas does not exist and makes a short-term commitment to focus environment improvement in areas already identified as the 'most deprived' by the Index of Multiple Deprivation, with the tackling of inequalities to be pursued by joined-up initiatives at a local level (Defra 2005, p.134). Prioritising those deprived areas where multiple and cumulative environmental impacts appear to exist and developing local level research and intervention would be an appropriate way for the Environment Agency and other local service providers to respond to this commitment.

In view of this context and the set of key questions identified above, this report makes the following recommendations.

Recommendation 1
Future work on understanding and assessing cumulative and multiple impacts should be developed in an inclusive, participatory way including those on whom these impacts fall.

This is a general overarching principle which should be adopted in future work. It should require:

- the involvement of stakeholder institutions and groups at national, regional and local levels;
- the use of methods which enable the effective participation of ordinary members of the public.

Recommendation 2

Research should be undertaken to inform the Sustainable Development Strategy commitment to focus environmental improvement in areas most in need. This research should:

- assess local stakeholders and citizens perceptions of local environmental inequalities and how these may be measured, and their views on potential solutions;

- evaluate from recent research and from local stakeholders 'what works' in practice in the design, delivery and roll-out of area-based neighbourhood initiatives aimed at improving aspects of the physical environment and tackling multiple dimensions of deprivation

This research could take a number of formats depending on resource and time constraints. The first of the three case study approaches discussed in Section 5.3 could be appropriate. Alternatively, in order to capture a range of perceptions and experience, more focused research could be undertaken across a number of different deprived neighbourhoods, achieving breadth through compromising to some degree on depth.

Recommendation 3
Exploratory case study research on cumulative environmental impacts and inequalities is needed to provide an opportunity to develop conceptual clarity and reflection, as well as to generate empirical results.

The UK Sustainable Development strategy presents an immediate policy driver. However, there is a medium- to longer-term need for research that seeks to address the substantial challenges involved in understanding and assessing how multiple environmental impacts can accumulate, interact, sometimes synergistically, and affect some social groups more than others. Section 5 outlined a set of key questions to be considered in formulating case study research and proposed three ways in which case study work could be pursued.

Recommendation 4
The potential approaches to case study research proposed in this report should be evaluated by a multi-stakeholder group in the context of the issues of definition, scope, policy relevance and ethics that have been outlined.

Following the principle laid out in Recommendation 1, the proposed case study research should not only be carried out in a way which involves multiple stakeholders and local people as subjects of research, but which through 'upstream engagement' involves them at the earliest stages in the process of research design and development.

Each of the three ways of undertaking case study research provides a different approach to addressing the cumulative impacts of environmental inequalities in deprived areas. Each has their own strengths and weaknesses.

The appropriate route forward can be selected based on an assessment of these discussions, current research and policy initiatives, and available resources. A multi-stakeholder approach will be needed and this should be put in place from the earliest stages.

Recommendation 5
As experience with SEA develops, an evaluation should be made of how effectively this is operating as a tool for;

- assessing cumulative environmental impacts;
- analysing the distributional implications of environmental change.

References and bibliography

Acheson D (chairman), Barker D, et al. 1998 *Independent inquiry into inequalities in health Report*. London: The Stationery Office. Available from: http://www.archive.official-documents.co.uk/document/doh/ih/ih.htm [Accessed 8 September 2005]

Agyeman J and Evans B, 2004. *Just sustainability: the emerging discourse of environmental justice in Britain?* Geographical Journal, **170**, 155–164.

Anon 1994 *The people's movement for environmental justice*. Health Progress, **75**, No. 7, 12.

Arcury T A, Quandt S A and McCauley L, 2000 *Farmworkers and pesticides: community-based research*. Environmental Health Perspectives, **108**, No. 8, 787–792.

Army Corp of Engineers, 1991 *Elk Creek Lane Final Environmental Impact Statement*. Portland, OR: Army Corp of Engineers.

Blair T, 2003 Prime Minister's speech on sustainable development, 24 February 2003. Available from: http://www.number10.gov.uk/output/Page7073.asp [Accessed 8 September 2005]

Boardman B, Bullock S and McLaren D, 1999 *Equity and the Environment: Guidelines for Green and Socially Just Government*. London: Catalyst Trust and Friends of the Earth.

Brismar A, 2004 *Attention to impact pathways in EISs of large dam projects*. Environmental Impact Assessment Review, **24**, No. 1, 59–87

Brook Lyndhurst, 2004 *Environmental exclusion review*. London: Neighbourhood Renewal Unit, Office of the Deputy Prime Minister. Available from: http://www.brooklyndhurst.co.uk/publications.php?smid=151 [Accessed 8 September 2005]

Bullard R D and Wright B H, 1993 *Environmental justice for all: community perspectives on health and research needs*. Toxicology and Industrial Health, **9**, No. 5, 821–841.

Burningham K and Thrush D, 2001 "*Rainforests are a long way from here": the environmental concerns of disadvantaged groups*. Report for the Joseph Rowntree Foundation. York: York Publishing Services.

Canter L, 1997 *Cumulative impacts and EIA: the use of questionnaire checklists* [online]. EIA Newsletter 14 Summer 1997. Manchester: EIA Centre, Planning and Landscape, University of Manchester. Available from: http://www.art.man.ac.uk/EIA/publications/newsletters/newsletter14/cumulativeimpacts/questtionaires.htm [Accessed 8 September 2005]

Canter L W and Kramath J, 1995 *Questionnaire checklist for cumulative impacts*. Environment Impact Assessment Review, **15**, 311–339.

Centers for Disease Control and Prevention (CDC), 1999 *Program to facilitate environmental justice in minority and under served communities; notice of availability of funds. Agency for Toxic Substances and Disease Registry.* Federal Register, **64**, No. 99, 27993–27934.

Chalmers H and Colvin J, 2005 *Addressing environmental inequalities in UK policy: an action research perspective*. Local Environment, **10**, No. 4, 333–360.

Coalition on Access to Justice for the Environment, 20045 *Access to Environmental Justice: Making it Affordable*. Available from: http://www.elflaw.org/files/CAJE Briefing.pdf [Accessed 8 September 2005]

Cooper L M and Sheate W R, 2002 *Cumulative effects assessment: a review of UK environmental impact statements*. Environmental Impact Assessment Review, **22**, 415–439.

Corborn J, 2000 *Shifting the discourse of risk through cumulative risk assessment.* In Proceedings of Annual International Conference on Towards Sustainability: Social and Environmental Justice (Tufts University, Boston, June 2000). London: Royal Geographical Society, Planning and Environment Research Group

Corburn J, 2002a *Environmental justice, local knowledge, and risk: the discourse of a community-based cumulative exposure assessment*. Environmental Management, **29**, No. 4, 451–466.

Corburn J, 2002b *Combining community-based research and local knowledge to confront asthma and subsistence-fishing hazards in Greenpoint/Williamsburg, Brooklyn, New York*. Environmental Health Perspectives, **110** Suppl 2, 241–248.

Coughlin S S, 1996 Environmental justice: the role of epidemiology in protecting unempowered communities from environmental hazards. Science of the Total Environment, **184**, No. 1–2, 67–76.

Council on Environmental Quality (CEQ), 1997 *Considering cumulative effects under the National Environmental Policy Act*. Washington DC: CEQ. Available from: http://ceq.eh.doe.gov/nepa/ccenepa/ccenepa.htm [Accessed 8 September 2005]

CSV Environment, 2002 Concrete to Coriander and Bangladesh Women's Community Garden at Small Heath Park in Birmingham [online]. London: CSV. http://www.csv.org.uk/Volunteer/Whats+Your+Interest/Environment/Environment+Projects+-+Concrete+to+Coriander.htm [Accessed 8 September 2005]

Cutter S L, Scott M S and Hill A A, 2002 *Spatial variability in toxicity indicators used to rank chemical risks*. American Journal of Public Health, **92**, No. 3, 420–422.

Davey-Smith G and Ebrahim S, 2001 *Epidemiology – is it time to call it a day?* International Journal of Epidemiology, **30**, 1–11.

Department for Environment, Food and Rural Affairs (Defra), 2004 *Taking it on – developing UK sustainable development strategy together. A consultation paper*. London: Defra. http://www.sustainable-development.gov.uk/documents/publications/consult.pdf [Accessed 8 September 2005]

Department for Environment, Food and Rural Affairs (Defra), 2005 *Securing the future: delivering UK sustainable development strategy*. London: Defra. http://www.sustainable-development.gov.uk/publications/uk-strategy/uk-strategy-2005.htm [Accessed 8 September 2005]

Dolk H, Vrijheid M, Armstrong B, Abramsky L, Bianchi F, Game F, Nelen V, Robert E, Scott J E S, Stone D and Tenconi R, 1998 *Risk of congenital anomalies near hazardous*

waste landfill sites in Europe: the EUROHAZCON study. Lancet**, 352**, No. 9126, 423–427.

Dunion K, 2003 *Trouble Makers. The Struggle for Environmental Justice in Scotland*. Edinburgh: Edinburgh University Press

English Nature, 2005 *Going, going, gone? The cumulative impact of land development of biodiversity in England*. English Nature Research Report 626. Peterborough: English Nature. Available from: http://www.english-nature.org.uk/pubs/publication/PDF/626.pdf [Accessed 8 September 2005]

Environment Agency, 2002a *The urban environment in England and Wales: a detailed assessment.* Bristol: Environment Agency. Available from: http://www.environment-agency.gov.uk/yourenv/857406/353880/363999/?lang=_e [Accessed 8 September 2005]

Environment Agency, 2002b *Our urban future: putting the environment at the heart of urban renewal*. Bristol: Environment Agency. Available from: http://www.environment-agency.gov.uk/yourenv/857406/353880/364533/?lang=_e [Accessed 8 September 2005]

Environment Agency, 2002c *Environmental Impact Assessment (EIA): a handbook for scoping projects*. Bristol: Environment Agency.

Environment Agency, 2004 *Addressing environmental inequalities.* Position Statement. Bristol: Environment Agency. Available from: http://www.environmentagency.gov.uk/aboutus/512398/289428/888451/?lang=_e[Accessed 8 September 2005]

European Commission Directorate General XI Environment, Nuclear Safety and Civil Protection, 1999a *Guidelines for the assessment of indirect and cumulative impacts as well as impact interactions*. Luxembourg: European Commission/Hyder Consulting. Available from: http://europa.eu.int/comm/environment/eia/eia-studies-and-reports/guidel.pdf [Accessed 8 September 2005]

European Commission Directorate General XI Environment, Nuclear Safety and Civil Protection, 1999b. *Final report on the study on the assessment of indirect and cumulative impacts as well as impact interactions, within the Environmental Impact Assessment (EIA) process*. *Volume 1: Background to the Study*. Luxembourg: European Commission/Hyder Consulting. Available from: http://europa.eu.int/comm/environment/eia/eia-studies-and-reports/volume1.pdf [Accessed 8 September 2005]

European Commission Directorate General XI Environment, Nuclear Safety and Civil Protection, 1999c *Final report on the study on the assessment of indirect and cumulative impacts as well as impact interactions, within the Environmental Impact Assessment (EIA) process. Volume 2: Research study and findings.* Luxembourg: European Commission/Hyder Consulting. Available from: http://europa.eu.int/comm/environment/eia/eia-studies-and-reports/volume2.pdf [Accessed 8 September 2005]

Evans G W and Kantrowitz E, 2002 *Socioeconomic status and health: the potential role of environmental risk exposure*. Annual Review of Public Health, **23**, 303–331.

Evans G W and Marcynyszyn L A, 2004 *Environmental justice, cumulative environmental risk, and health among low- and middle-income children in upstate New York*. American Journal of Public Health, **94**, 1942–1944

Faber D R and Krieg E J, 2002 *Unequal exposure to ecological hazards: environmental injustices in the Commonwealth of Massachusetts*. Environmental Health Perspectives, **110**, Suppl 2, 277–288.

Federal Energy Regulatory Commission (FERC), 1988 *Final Environmental Impact Statement for Hydroelectric Development in Upper Ohio River Basin. Ohio, PA*. Washington, DC: FERC, Office of Hydropower Licensing

Finsterbusch K, 1980 *Understanding Social Impacts*. Beverley Hills, CA: Sage.

Foley J, 2004 Editor *Sustainability and Social Justice.* London: Institute of Public Policy Research.

Folke C, Carpenter S, Elmqvist T, Gunderson L, Holling C S, Walker B, *et al.* 2002 *Resilience and sustainable development: building adaptive capacity in a world of transformations*. Stockholm: Environment Advisory Council to the Swedish Government. Available from: http://www.sou.gov.se/mvb/pdf/resiliens.pdf [Accessed 9 September 2005]

Fox M A, Groopman J D and Burke T A, 2002 *Evaluating cumulative risk assessment for environmental justice: a community case study*. Environmental Health Perspectives, **110**, Suppl 2, 203–209.

Gee D, 1999 *Children in their environment: vulnerable, valuable and at risk: Background briefing children and environmental health*. In Proceedings of World Health Organization 3rd Ministerial Conference on Environment and Health (London, June 1999). Copenhagen: European Environment Agency.

Gee G C and Payne-Sturges D C, 2004 *Environmental health disparities: a framework integrating psychosocial and environmental concepts*. Environmental Health Perspectives, **112**, No. 17, 1645–1653.

Hartley N and Wood C, 2005 *Public participation in environmental impact assessment - implementing the Aarhus Convention*. Environment Impact Assessment Review, **25**, No. 4, 319–340.

Hegmann G, Cocklin C, Creasey R, Dupuis S, Kennedy A, Kingsley L, Ross W, Spaling H, Stalker D and AXYS Environmental Consulting Ltd, 1999 *Cumulative Effects Assessment Practitioners Guide*. Ottawa: Canadian Environmental Assessment Agency (CEAA). Available from: http://www.ceaa-acee.gc.ca/013/0001/0004/index_e.htm [Accessed 12 September 2005]

International Association for Impact Assessment (IAIA), 2003 *Social impact assessment: international principles*. Special Publication Series No. 2. Fargo, North Dakota: ISIA. http://www.iaia.org/Members/Publications/Guidelines_Principles/SP2.pdf [Accessed 9 September 2005]

Jacobs M, 1999 *Environmental Modernisation: the New Labour Agenda.* Pamphlet 591. London: Fabian Society.

James E, Tomlinson P, McColl V and Fry C, 2003 *Final report – Literature review/scoping study on cumulative effects assessment and the Strategic Environmental Assessment Directive*. Unpublished Project Report PR SE/730/03 prepared by the Centre for Sustainability at TRL Limited for the Environment Agency Centre for Risk and Forecasting.

Kearney M, 2004 *Walking the walk? Community participation in HIA: a qualitative interview study*. Environmental Impact Assessment Review, **24**, 217–229.

Krieg E J and Faber D R, 2004 *Not so black and white: environmental justice and cumulative impact assessments*. Environmental Impact Assessment Review, **24**, No. 7–8, 667–694.

Liu F, 2001 *Environmental Justice Analysis: Theories, Methods and Practice*. Boca Raton, Florida: Lewis Publishers.

London School of Economics (LSE), 2005a *The ESRC Centre for Analysis of Social Exclusion* [online]. Available from: http://sticerd.lse.ac.uk/case/ [Accessed 9 September 2005]

London School of Economics (LSE), 2005b *Dynamics of low income areas* [online]. London: Centre for Analysis of Social Exclusion, LSE. Available from: http://sticerd.lse.ac.uk/case/research/lowincome.asp [Accessed 9 September 2005].

Lucas K, Walker G, Eames M, Fay H and Poustie M, 2004a *Environment and social justice: rapid research and evidence review*. Report for the Sustainable Development Research Network (SDRN). PSI Report No: 901. London: Policy Studies Institute.

Lucas K, Fuller S, Psaila A and Thrush D, 2004b *Prioritising local environmental concerns: where there's a will there's a way*. Report for the Joseph Rowntree Foundation. York: York Publishing Services.

Maantay J, 2002 *Mapping environmental injustices: Pitfalls and potential of geographic information systems in assessing environmental health and equity*. Environmental Health Perspectives, **110**, Suppl 2, 161–171.

McBride G, 1999 *Scottish Applications of Environmental Justice*. Edinburgh: University of Edinburgh.

McConnell J, 2002 First Minister's speech on the Scottish Executive policy on environment and sustainable development to the Dynamic Earth Conference, Edinburgh, 18 February 2002. Available from: Available from: http://www.scotland.gov.uk/News/News-Extras/57 [Accessed 9 September 2005]

Mennis J, 2002 *Using geographic information systems to create and analyze statistical surfaces of population and risk for environmental justice analysis.* Social Science Quarterly, **83**, No. 1, 281–297.

Mindell J and Joffe M. 2003 *Health impact assessment in relation to other forms of impact assessment*. Journal of Public Health Medicine, **25**, No. 2, 107–112.

National Assembly for Wales (NAW), 2000 *Welsh Index of Multiple Deprivation* [online] Available from: http://www.wales.gov.uk/keypubstatisticsforwalesheadline/content/social/2000/hdw20000904a_e.htm [Accessed 9 September 2005]

Natural Resources Canada (NRC), 1996 *Environmental Assessment Manual*. Ottawa: Office of Environmental Affairs, Natural Resources Canada

North Carolina Department of Environment and Natural Resources (NCDENR), Division of Coastal Management, 2004 Maps and data: cumulative and secondary impacts

[online]. Rayleigh, NC: NCDENR Division of Coastal Management. Available from: http://dcm2.enr.state.nc.us/Maps/impacts.htm [Accessed 9 September 2005]

O'Fallon L R and Dearry A, 2002 *Community-based participatory research as a tool to advance environmental health sciences*. Environmental Health Perspectives, **110**, 155–159.

Office of the Deputy Prime Minister, Social Exclusion Unit, 2003 *Making the connections: final report on transport and social exclusion.* London: Social Exclusion Unit, ODPM. Available from: http://www.socialexclusionunit.gov.uk/publications.asp?did=229 [Accessed 9 September 2005]

Office of the Deputy Prime Minister/Neighbourhood Renewal Unit (ODPM/NRU), 2004 *Achieving environmental equity through neighbourhood renewal: policy and practice guide.* London: Neighbourhood Renewal Unit, ODPM. Available from: http://www.renewal.net/Documents/RNET/PolicyGuidance/Achievingenvironmentalequity.pdf [Accessed 9 September 2005]

Office of the Deputy Prime Minister (ODPM), 2004a *Indices of deprivation 2004* [online]. London: ODPM. Available from: http://www.odpm.gov.uk/stellent/groups/odpm_control/documents/contentservertemplate/odpm_index.hcst?n=4610&l=3 [Accessed 9 September 2005]

Office of the Deputy Prime Minister (ODPM), 2004b *A draft practical guide to the Strategic Environmental Assessment Directive: Proposals by ODPM, the Scottish Executive, the Welsh Assembly Government and the Northern Ireland Department of the Environment for practical guidance on applying European Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment*. London: ODPM. Available from: http://www.odpm.gov.uk/stellent/groups/odpm_planning/documents/page/odpm_plan_029817.pdf [Accessed 9 September 2005]

Office of the Deputy Prime Minister (ODPM), 2004c. *Environmental impact assessment: guide to procedures*. London: ODPM. Available from: http://www.odpm.gov.uk/stellent/groups/odpm_planning/documents/page/odpm_plan_026667.hcsp [Accessed 9 September 2005]

Paskell C and Power A, 2005 *'The future's changed': local impacts of housing, environment and regeneration policy since 1997.* CASE Report 29. London: ESRC Research Centre for Analysis of Social Exclusion, London School of Economics. Available from: http://sticerd.lse.ac.uk/dps/case/cr/CASEreport29.pdf [Accessed 9 September 2005]

Perlin S A, Wong D and Sexton K, 2001 *Residential proximity to industrial sources of air pollution: interrelationships among race, poverty, and age*. Journal of the Air and Waste Management Association, **51**, No. 3, 406–421.

Ponizovsky A and Perl E, 1997. *Does supported housing protect recent immigrants from psychological distress?* International Journal of Social Psychiatry, **43**, No. 2, 79-86.

Powell D L and Stewart V, 2001 *Children. The unwitting target of environmental injustices*. Pediatric Clinics of North America, **48**, No. 5, 1291–1305.

Roberts S M, 2000 *Environmental justice: examining the role of risk assessment*. Human and Ecological Risk Assessment, **6**, No. 4, 537–540.

Ryder R, 1999 *'No-one ever died from dioxin': the dioxin problem in Britain*. The Ecologist, **29**, No. 6, 369–374.

Scandrett E, Dunion K and McBride G, 2000 *The campaign for environmental justice in Scotland*. Local Environment, 5, No. 4, 467–474.

Schwarz C D et al. 1988 Editors *Chambers English Dictionary* (7th edn.). Cambridge: W & R Chambers Ltd.

Science Policy Council, US Environmental Protection Agency (USEPA), 1997 *Guidance on cumulative risk assessment. Part 1: Planning and scoping*. Washington, DC: USEPA. Available from: http://www.epa.gov/swerosps/bf/pdf/cumrisk2.pdf [Accessed 9 September 2005]

Scottish Executive, 2005 *Environmental justice* [online]. Available from: http://www.scotland.gov.uk/about/ERADEN/SCU/00017108/environjust.aspx [Accessed 9 September 2005]

Simon T W, 2000 In defense of risk assessment: a reply to the environmental justice movement's critique. Human and Ecological Risk Assessment, **6**, No. 4, 555–560.

Social Disadvantage Research Centre, 2004. The English Indices of Deprivation 2004: Summary (Revised). London: University of Oxford/Office of the Deputy Prime Minister. http://www.odpm.gov.uk/stellent/groups/odpm_urbanpolicy/documents/pdf/odpm_urbpol_pdf_028470.pdf [Accessed 9 September 2005]

Stephens C, Bullock S and Scott A, 2001 *Environmental justice: rights and mean to a healthy environment for all.* Special Briefing Paper . Economic and Social Research Council (ESRC) Global Environmental Change Programme. Brighton: ESRC Global Environmental Change Programme, University of Sussex. Available from: http://www.foe.co.uk/resource/reports/environmental_justice.pdf [Accessed 9 September 2005]

Stephens C and Bullock S, 2002 *Environmental justice: an issue for the health for the children of Europe and the world*. In Children's Health and Environment: a Review of Evidence (ed. G Tamburlini, O v. Ehrenstein and R Bertollini), pp. 190–198. Environment Issue report 29. Rome: World Health Organization Regional Office for Europe/European Environment Agency. Available from: http://reports.eea.eu.int/environmental_issue_report_2002_29/en [Accessed 8 September 2005]

Stephens C Stevenson S, Landon M, Pattendon S, Wilkinson P and Fletcher T, 1998 *Examining the inequality and inequity of car ownership and the effects of pollution and health outcomes such as respiratory diseases*. Epidemiology, **9**, No. 4. S29.

Stephens C, Stevenson S Landon M, Fletcher T, Wilkinson P and Grundy C, 1999 *Examining the inequality of car ownership and the effects of pollution and health outcomes*. Presentation to the Healthy Planet Forum (June 1999), Environmental Epidemiology Unit, London School of Hygiene and Tropical Medicine, London.

Sustainable Development Commission, 2002 *Vision for Sustainable Regeneration. Environment and Poverty – Breaking the Link?* London: Sustainable Development Commission.

The Interorganizational Committee on Principles and Guidelines for Social Impact Assessment, 2003 *Principles and guidelines for social impact assessment in the USA*. Impact Assessment and Project Appraisal, **21,** No. 3, 231–250.

Turner BL II, Kasperson RE, Matson P A, McCarthy J J, Corell R W, Christensen L, *et al.* 2003 *A framework for vulnerability analysis in sustainability science*. Proceedings of the National Academy of Science of the United States of America, **100**, No. 14, 8074–8079.

United Nations Economic Commission for Europe (UNECE), 1998 *Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters*. Geneva: UNECE.

US Forest Service and US Bureau of Land Management (BLM), 1994 *Final supplemental environmental impact statement on management of habitat for late-successional and old-growth forest-related species within the range of the Northern Spotted Owl.* Portland, OR: US Department of Agriculture (USDA) Forest Service/US Department of the Interior (USDI) BLM.

US Environmental Protection Agency (USEPA), 1998 *Final guidance for incorporating environmental justice concerns in EPA's NEPA compliance analyses*, Washington DC: USEPA. Available from: http://www.epa.gov/compliance/resources/policies/ej/ej_guidance_nepa_epa0498.pdf [Accessed 9 September 2005]

US Environmental Protection Agency (USEPA), *2003 Framework for Cumulative Risk Assessment.* Office of Research and Development, National Center for Environmental Assessment, Washington Office, Washington, DC, EPA/600/P-02/001F. Available from: http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=54944 [Accessed 25 November 2005]

Walker G, Fairburn J, Smith G and Mitchell G, 2003 *Environmental quality and social deprivation.* R&D Technical Report E2-067/1/TR. Bristol: Environment Agency.

Walker G, Fay H and Mitchell G, 2005 *Environmental Justice Impact Assessment. An evaluation of requirements and tools for distributional analysis*. London: Friends of the Earth. Available from: http://www.foe.co.uk/resource/reports/ej_impact_assessment.pdf[Accessed 9 September 2005]

Walker G, Damery S, Smith G and Petts J, 2006, *Addressing Environmental Inequalities in Wales*, R&D Technical Report Bristol, Environment Agency

Weisglas-Kuperus N, Vreugdenhil H J and Mulder P G, 2004 *Immunological effects of environmental exposure to poly-chlorinated biphenyls and dioxins in Dutch school children*. Toxicology Letters, **149**, No. 1–3, 281–285.

Williams C, 1998 *Environmental Victims: New Risks, New Injustice*. London: Earthscan.

Wing S, Cole D and Grant G, 2000 *Environmental injustice in North Carolina's hog industry*. Environmental Health Perspectives, **108**, No. 3, 225–231.

Women's Environmental Network (WEN), 1999 *Putting breast cancer on the map* [online]. London: WEN. Available from: http://www.wen.org.uk/health/PBCOM/breast.htm [Accessed 9 September 2005]

Wood C, Barker A J and Jones C E, 1997 Editors *Cumulative Impacts and EIA* [online]. EIA Newsletter 14 Summer 1997. Manchester: EIA Centre, Planning and Landscape, University of Manchester. Available from: http://www.art.man.ac.uk/EIA/publications/newsletters/newsletter14/index.htm [Accessed 9 September 2005]

Young H P, 1994 *Equity in Theory and Practice.* Princeton, NJ: Princeton University Press

List of acronyms

CASE	Centre for Social Exclusion, London School of Economics
CEA	Cumulative Effects Assessment
CEAA	Canadian Environmental Assessment Agency
CEQ	Council on Environmental Quality
Defra	Department for Environment, Food and Rural Affairs
EC	European Commission
EIA	Environmental Impact Assessment
ESRC	Economic and Social Research Council
FoE	Friends of the Earth
GIS	Geographical information system
IMD	Index of Multiple Deprivation
NCDCM	Division of Coastal Management of the North Carolina Department of Environment and Natural Resources
NGO	non-governmental organisation
LSE	London School of Economics and Political Science
ODPM	Office of the Deputy Prime Minister
PCBs	polychlorinated biphenyls
SEA	Strategic Environmental Assessment
SDRN	Sustainable Development Research Network
USEPA	US Environmental Protection Agency
WEN	Women's Environmental Network

Appendix 1: Workshop Summary

A project workshop was held from 2–3 February 2005 at Wast Hills House Conference Centre in Birmingham. One day was devoted to the cumulative impacts section of the project. A range of stakeholders both internal and external to the Environment Agency was invited in order to draw on a breadth of expertise and experience. External participants included representatives from Defra, the National Assembly of Wales, Hackney Local Strategic Partnership, Friends of the Earth and the Black Environment Network. The workshop was interactive with a focus on discussion and the involvement of all participants.

The specific aims of the workshop day focused on cumulative impacts were to:

- collectively consider the meaning of 'cumulative environmental impacts' and when, where and why we might need to understand and assess these in relation to deprived communities;

- consider and evaluate different potential approaches to, and methods for assessing, cumulative environmental impacts in deprived communities.

The outcomes of activities developed by the workshop facilitators in pursuit of these aims are reported below.

Workshop activities: understanding cumulative impacts

Both workshop activities helped to:

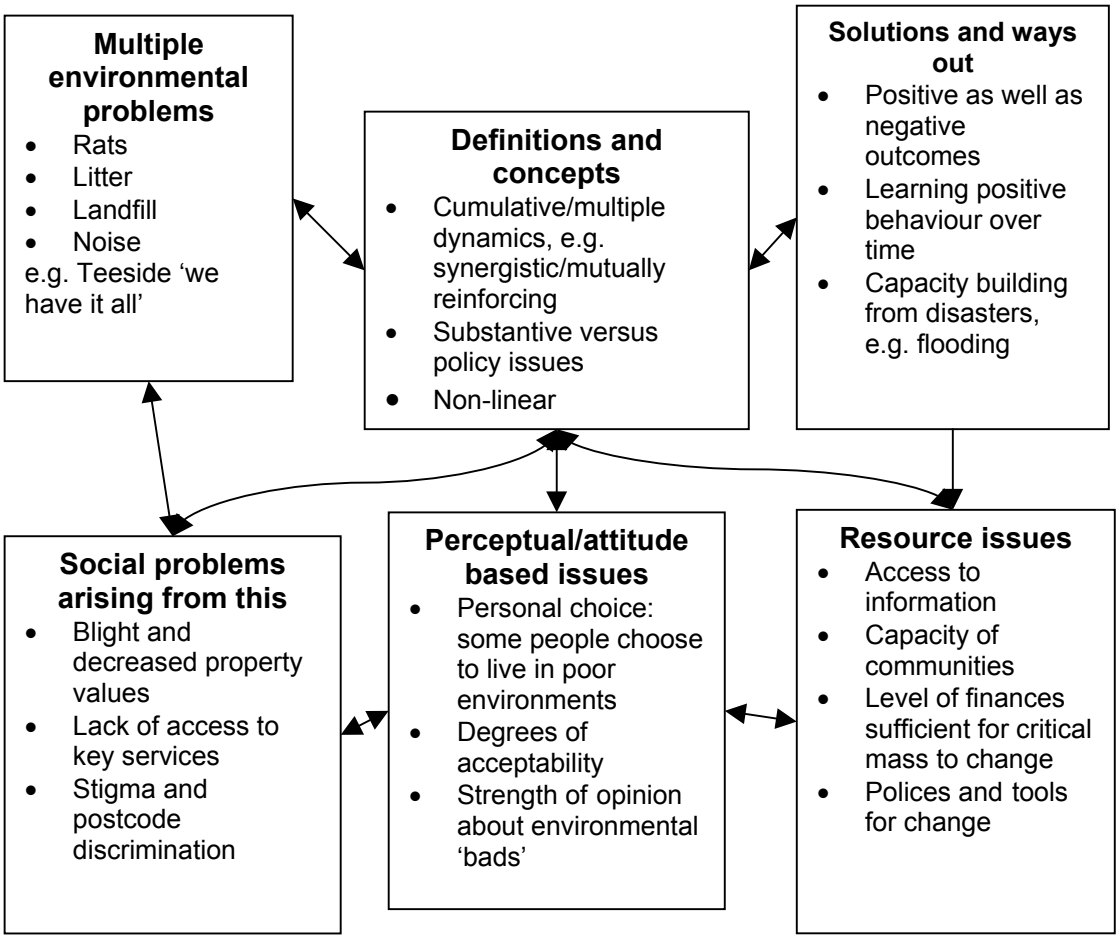
- explore issues raised in the literature review;
- suggest new approaches and emphases for the case study scoping section.

Activity 1: Cumulative impacts in practice

In pairs, participants were asked to brainstorm what 'cumulative environmental impacts' meant in practice to them from their own different experiences.

Interpretations were then reported back to the whole group with the facilitator asking 'who has a similar example?' and grouping similar themes together. The facilitator then mapped key themes (Figure A1).

Figure A1 Key themes from Activity 1



Discussion

This activity was the first item on the day's agenda and was completed before any formal presentations were made. Participants therefore drew entirely on their own experiences to interpret 'cumulative environmental impacts'. The results of the activity reflected the varying backgrounds of participants and identified some conceptual areas that had not arisen during the literature review.

Definitions and concepts
Initial discussion of cumulative environmental impacts immediately identified some of the same issues as those raised in reviewing the literature concerning the complication of recognising and classifying cumulative and multiple impacts and their interaction pathways. One participant wrote 'cumulative impacts can be almost anything'. Additionally, the differentiation between substantive and policy issues was recognised, with government representatives pointing out the importance of looking at their relationship and focusing on 'upstream' factors.

Understanding why people are exposed to cumulative environmental impacts
All participants were aware that this workshop was being held in the context of 'understanding environmental inequalities', but had different ideas about causes of exposure to cumulative environmental impacts.

The diversity of disciplinary perspectives was evident with varying focus on the individual and wider systems. NGO representatives talked about resource-based issues from their experiences working with communities – lack of access to information, economic pressures when a polluting factory is the main employer in an area, access to services. Others suggested that people may choose to live in poor environments, citing the example of the ICI Runcorn site where families chose to buy cheap homes, raising the issue of economic influences on decisions and how acceptability of risk is influenced by individual situation.

Drawing attention to wider impacts
Wider social and economic impacts beyond those immediately associated with 'environment' were discussed. These included blight and decreasing property values, stigma and postcode discrimination, spirals of decline, vandalism and lack of respect for local environment examples. These examples may be relevant to formal environmental assessment methodologies but are rarely included due to the difficulty of assessing cumulative impacts in practice.

Positive angles

The exercise also drew out an alternative perspective for considering cumulative environmental impacts: working from a positive angle. Literature review findings focused largely on negative aspects. Members of the workshop group suggested:

- focusing on positive aspects of local communities as a basis for capacity building;
- understanding why some communities are less vulnerable than others;
- looking at positive as well as negative impacts.

Looking at positive impacts is advised in some environmental assessment methodology but, again, is rarely considered in the context of cumulative impacts.

Activity 2: Constructing pathways of decline and improvement

The facilitators introduced a 'snakes and ladders' activity. Participants were asked to work in pairs, thinking of an example of cumulative environmental impacts on a specific vulnerable group and then identifying steps of environmental decline (snakes) and possible steps of policy responses (ladders) to reverse the decline. Examples were reported back to the main group for discussion. Summaries are shown in Figure A2.

Figure A2 Summaries of ideas from Activity 2

Group 1: Air quality – pathways of decline and improvement

Vulnerable group: people with bronchial and respiratory diseases

Steps of decline:

1) Poor air quality
2) Traffic point sources
3) Exacerbates ill-health among vulnerable sectors of population; cumulative effects with other environmental and individual characteristics.
4) Affects rural and urban areas but enhanced incidence of disease in deprived communities?

Steps of improvement:

1) Access to information for individual action
2) Availability, comprehension, relevance
3) Ability to act – resources, access to healthcare, etc.
4) Behavioural change, economic, resources and cultural change
5) Local Air Quality Management – direct control (traffic free areas, regulation of point sources), clean technology

Group 2: Heavy traffic – pathways of decline and improvement

Vulnerable group: families, parents with children on benefits

Steps of decline

1) Air pollution
2) Noise
3) Accidents
4) Road as a divisive tool cutting area in half
5) Congestion from through traffic

Steps of improvement:

1) Road design
2) New bridges and tunnels
3) Traffic-calming measures
4) Sound-proof housing, housing location, car design and new technology
5) Public transport, congestion charging, pedestrian areas

3) Waste disposal: pathways of decline and improvement.

Several groups worked on this topic but only one identified a pathway of improvement. No vulnerable groups were specified.

Group 3.1 Landfill site

Steps of decline:
1) Nuisance – odour, noise, sounds, rats, flies
2) Economic – house prices fall, people move out of the area
3) Amenities decrease – poorer education, poorer achievement
4) Stigmatisation – increases in crime, etc.
5) Locality becomes focus for more polluting activities – poor jobs – vicious cycle of decline

Steps of improvement:
None

Group 3.2 Location of new waste site

Steps of decline:
1) Anger, confusion, need for reliable information
2) Fear for health, property value, blight, traffic, etc.
3) Actual experience of some/all fears plus nuisance, dust, traffic emissions ...
4) Blight, postcode stigma, population able to move out do so
5) Further decline and less respect/ownership leads to vandalism and graffiti, etc. Poorer quality of services

Steps of improvement:
None

Group 3.3 Landfill site

Steps of decline:
1) Loss of land, smells, traffic
2) Pollution, air quality, water quality, contamination
3) Road safety, asthma, house price reductions
4) Concentration of similar developments in area
5) Play areas, basic enjoyment of property, lost leading
6) Isolation – those who can move away leaving behind a higher proportion of vulnerable groups

Steps of improvement:
1) Securing better conditions on licences, methane use
2) Recycling facilities
3) Ensure improvement in operation, e.g. movement of trucks
4) Form action group and challenge decisions
5) Recognition and desire to do something – community take control of facility and have an active role in its management

4) Poor housing: pathways of decline and improvement.

Two groups selected this topic. No vulnerable groups were identified.

Group 4.1

Steps of decline:	*Steps of improvement*
1) Unemployed and live in council tower block 2) Poor health – physical and psychological 3) Can't get out leading to depression, isolation and lack of social cohesion 4) Lack of social mobility, empowerment and hope 5) Not feeling like you can do anything about your environment	1) Look into lessons of locally devolved decision-making (from Porto Alegre and others) 2) Community involvement in participatory budget decisions 3) Community-designed environmentally sound council housing

Group 4.2

Steps of decline:
1) Poor health
2) Poor diet and lack of exercise
3) Lack of access to shops and poor transport links
4) Types of shops and provision in local area
5) Lack of knowledge

Two parallel routes of improvement:

EMPOWERMENT	POLICY
1) Education 2) Community food co-op 3) Community transport/introducing local travelling market 4) Increasing knowledge, providing examples 5) Good health regime	1) Life-long learning 2) Planning rules ensuring shop mix – via rent/rates 3) Transport planning and investment 4) Labelling, policy campaigns (e.g. five fruits a day) 5) Health provision

Group 5 Land contamination

Steps of decline:	*Steps of improvement:*
1) Caused by historic policy decision 2) Psychological pressures on community 3) Policy uncertainty 4) Negative feedback loop	1) Who drives solutions/decisions? 2) Access to information 3) Involve people in options appraisal 4) Customise options to address policy uncertainties

Discussion

This exercise allowed workshop participants to take a realistic situation and address some of the issues that researchers discussed at the literature review stage.

Non-linear problem
Immediately obvious was the mismatch between the suggested linear steps of decline and improvement route, and the non-linear nature of the problem. Both multiple causal factors and multiple outcomes were identified. This was dealt with in different ways. Group 2 working on 'heavy traffic' listed general contributory factors while Group 3.3 working on a 'landfill site' identified a sequential chain. Participants suggested that a pathway approach may be more appropriate, but recognised that this may quickly become complicated and difficult to interpret.

Timescale
Linked to this was the question of identifying a timescale and starting point. One group began with an historical policy decision to cover uneven waste land with power station ash before building houses, looking back over half a century to identify preliminary factors. Others chose to begin with a current situation such as poor physical health or emotional responses to proposed waste site location, and extrapolate future impacts. This latter approach is similar to the EIA methodology discussed in the literature review.

Feedback loops
In addition to multiple, complex pathways, exercise participants noted the importance of feedback loops. Group 5, using the example of land contamination, identified a negative feedback loop between psychological pressures on the community and policy uncertainty, suggesting that this could be alleviated by involving community members in options appraisal.

Level of focus
As in Activity 1, the individual professional perspectives of participants and their baseline assumptions informed responses to the exercise. There was a contrast between micro and macro level approaches, with varying emphasis on individual agency versus wider social and economic determinants and policy. Group 4.2 working on poor housing chose a combined approach, listing parallel steps of improvement focusing on both policy innovations and their effects on individual/community empowerment.

These approaches reflect the different backgrounds and interests of participants, but are not irreconcilable. Considering the breadth and variety of factors encompassed by 'cumulative impacts', a macro level or combined approach provides an effective framework for the whole situation. Within this framework is space for micro level pathways.

Suggesting steps of improvement
A common suggestion in the exercise responses was the importance of community participation, ranging from providing information to project, budgetary and policy level decision-making. This was a useful workshop finding as, although community participation is a crucial component of environmental justice methodology, it did not feature in the standard environmental assessment procedures reviewed in the literature.

As well as conceptual and methodological difficulties in addressing 'cumulative impacts' in realistic examples, some groups had problems suggesting any appropriate steps of improvement. Two groups working on waste disposal reached the base of a 'cycle of decline' and were unable to find a way out. The group who proposed a chain of solutions for the waste disposal problem may have had a different level of approach and primary

assumptions. Their solutions began with ‘securing better conditions on licences, methane use’, suggesting some expert input – as this is neither broad policy nor local knowledge.

The difficulties of workshop participants in identifying solutions reflects the complexity of the problem and demonstrates one of the challenges of addressing cumulative impacts.

We are The Environment Agency. It's our job to look after your environment and make it **a better place** – for you, and for future generations.

Your environment is the air you breathe, the water you drink and the ground you walk on. Working with business, Government and society as a whole, we are making your environment cleaner and healthier.

The Environment Agency. Out there, making your environment a better place.

Published by:

Environment Agency
Rio House
Waterside Drive, Aztec West
Almondsbury, Bristol BS32 4UD
Tel: 0870 8506506
Email: enquiries@environment-agency.gov.uk
www.environment-agency.gov.uk