

UKCDS Work stream report

Report Title: Climate Change Research and Development Sciences¹

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Overview

The UK Collaborative on Development Sciences (UKCDS) has been established to facilitate improved coordination of the research activity on development sciences supported by UK government institutions, research councils and charitable foundations. Over the next 5 years, the UKCDS will help stakeholders and funders of development sciences to collaborate more effectively within a shared framework, and will help to ensure that the research they support becomes more relevant to national and international policies and has a greater impact on developing countries².

This report summarises the first phase of the UKCDS workstream on climate change research activities. The aim of this work was to provide the UKCDS Board and members with an update of the climate change research activity of each UKCDS member and to help identify existing or potential synergies and gaps of the research that is relevant to development sciences. In this analysis, UKCDS found that research in 2004-2005 directed at developing regions amounted to less than 2% of total Environment Research Funders Forum (ERFF) and Wellcome Trust spend of £69M on climate change science. ERFF research on climate change with a global relevance or wider applicability increases the spend by 36% and in the case of the Wellcome Trust by a further £50M. Despite low funding levels, (in the UK and internationally) the UK science base on climate change is amongst the leading countries both in terms of authorship in the main journals, citations on the topic, and contributions to the IPCC Fourth Assessment Reports. Whilst some relevant collaborations between UKCDS members have been identified, most work has been project rather than programme-based. There is evidence of increasing national and international collaboration and bi- and multi-laterally activities led by the UK. New research initiatives such as Living with Environmental Change (LWEC) and the DFID climate change research programme need to align to deliver, within a coherent policy framework, cross-cutting thematic areas of improved access to and uptake of climate risk information; promotion of human well-being as a core objective; and be measured in ways that incentivise outcomes-based research.

The draft report was presented to the UKCDS Board in December 2007. Board members highlighted that funders had increased their spend on climate change research since 2004-05 period. Moreover, though joint programme based activities were emerging, there was still a need to prioritise research that would benefit developmental outcomes. Board members agreed to produce a summary of current and future research needs, opportunities for collaboration and increased coordination in climate change research with relevance to development. The information from UKCDS members and other key stakeholders will be collated and synthesised by the UKCDS Secretariat for presentation at the UKCDS officials and board meetings in April 2008.

¹ UKCDS Paper Reference: UKCDS WP3.0_211207

² See www.ukcds.org.uk for more details.

UKCDS Work stream review:

Climate Change Research and Development Sciences

Final Report

28/12/07

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Executive summary

Key findings:

- The UK contributes disproportionately to publication output on climate change adaptation, uncertainty and human health in developing regions, and is second to the USA in terms of lead and contributing authorship of the IPCC Fourth Assessment Report.
- The Environment Research Funders' Forum (ERFF) 2004-05 project database, shows a very low level of direct spend (<£2M) on climate change **and** development science (~2% of all climate-related work, but 36% of projects have a potential global relevance). The Wellcome Trust funded ~£1M on climate change /health projects, £50M on related activities, in 2005.
- Funding has been project rather than programme-based.
- Progress has been made since 2004-05 in terms of international collaborations and efforts to coordinate activities bi- and multi-laterally within the UK.
- Some stakeholders and UKCDS members are currently reviewing strategies on climate change within their research agendas.
- A number of new initiatives or programmes e.g. Living With Environmental Change, (LWEC) or DFID's research strategy are being developed.
- UK research which has wider applicability is not captured in the review.

Background and objectives

The warming of the earth's climate is now unequivocal. The impacts of climate change are potentially abrupt and irreversible, and likely to vary across the globe (IPCC, 2007). The overall impact could be profound, affecting social, economic, health and environmental dimensions via, for example, increased water stress, vector-borne diseases, food scarcity and coastal flooding. Though developing countries have contributed least to greenhouse gas emissions, it is likely that the most vulnerable populations in the least developed countries will face the greatest threats.

The international response to adaptation has fallen far short of what is required (UNDP, 2007). Nonetheless, policy instruments do exist for coordinated action, both within the UK and internationally. In this context, the present review has the following objectives:

- To provide the UKCDS Board with an update of the climate change research activity of each UKCDS member and to inform on existing or potential synergies, gaps and duplications of the research that is relevant to development sciences;

- To make recommendations on maximising the current and future value of the research and how funding might be directed for future programmes;
- To communicate the outcomes and recommendations of the review to the wider stakeholder community.

Methodology

The review combined an analysis of primary and secondary data on recent and future climate change research relevant to development undertaken by UKCDS members and other stakeholders in the UK and internationally. Information on UK funding was obtained from the ERFF database; information on publication output from the Web of Science. Due to the broad definition of “development sciences” we separated funding that was climate change and development specific from spend that was directed towards a more general “global good” (but has potential relevance to development). In addition, key informant interviews were conducted with representatives of both policy and research dimensions of UKCDS member (where possible). The interviews gave an overview of the climate change research activity of each UKCDS member and helped to identify existing or potential synergies, opportunities, and barriers to research with respect to development sciences.

Conclusions

The UK science base on climate change is amongst the leading countries both in terms of authorship in the main journals, citations on the topic, and contributions to the IPCC Fourth Assessment Reports.

However, the findings suggest a very low level of direct spend on climate change **and** development science (~2% of all climate-related work in 2004-05, excluding the Wellcome Trust). The analysis also highlighted that most funders followed a project-rather than programme-based approach, thus diffusing the potential impact on developmental outcomes and increasing the risk of potential overlap and duplication with other agencies.

In reviewing research priorities, we deliberately avoided a thematic approach where knowledge gaps are brigaded along traditional disciplinary lines. We approached the task from the perspective of desired outcomes, as set out in the Millennium Development Goals: defining what research is needed to accomplish poverty alleviation in the face of climate change. From this perspective, there was clear evidence of an emerging consensus on three priority themes: climate risk, human well-being, effectiveness of interventions.

Recommendations

1. **Initiate a process to develop a coherent programme of research.** Identify a Working Group (WG) mechanism to improve coordination between members' research programmes, consolidate capacity building efforts, and align with international initiatives e.g., GECC/UKCDS, and link to LWEC. The WG could include representatives of UKCDS members, plus other government bodies (FCO, EA, MoD).
2. **Map each WG members' research programme to an agreed set of objectives.** For illustrative purposes only, research priorities drawn from DFID's consultation exercise were mapped to the draft strategic objectives of LWEC. A coherent framework would satisfy one of the key recommendations of UNDP (2007) that donors should move from project- to programme-based financing.
3. **Broaden the present analysis to include charitable foundations, NGOs and the private sector (e.g., insurance, energy, pharmaceutical).** This recognises that new players are entering the climate change arena and many have substantial research resources at their disposal. It is also important to ensure that private and public-sector research investments are optimally aligned.
4. **Identify and inform UKCDS members of funding opportunities within existing or new programmes.** There are opportunities to align the UK climate change and development science programme (in #2) with international initiatives using existing frameworks such as GSIF. Also to establish collaborative ventures with the EU GCCA and through the CAAST-NET (Coordination and Advancement of sub-Saharan Africa-EU Science and Technology Cooperation Network) to the EU FP7.
5. **Look at strategic options for incentivising outcomes-based research in the UK.** The forthcoming RAE consultation provides a timely opportunity for UKCDS members to submit suggestions. In parallel, to establish scientific evaluations and metrics to assess the cost-effectiveness, duration and scale of benefits of research-led interventions to alleviate poverty.

Introduction

The warming of the earth's climate is now unequivocal. The impacts of climate change are potentially abrupt and irreversible, and likely to vary across the globe (IPCC, 2007). Because of the inherent complexity of the underlying physical process and interactions driving climate variability, predicting the consequences of climate change on human populations and natural systems is not straightforward. The overall impact, however, could be profound, affecting social, economic, health and environmental dimensions via, for example, increased water stress, vector-borne diseases, food scarcity and coastal flooding.

To date, developing countries have contributed least to greenhouse gas emissions (Stern, 2006). But developing countries are more vulnerable to climate change than developed nations because of their heavy reliance on climate-sensitive activities, as well as their weak technical, institutional and financial capacities (Pachauri, 2002). Furthermore, it is likely that the most vulnerable populations in the least developed countries will face the greatest threats. A failure to respond to the issue of climate change could stall and even reverse progress made in achieving the Millennium Development Goals (see Annex 1).

According to the UN Human Development Report (2007) *the international response to adaptation has fallen far short of what is required*³. Nonetheless, policy instruments do exist for coordinated action. For example, the European Commission Green Paper on Adaptation to Climate Change (EU, 2007a) contains a pillar on *integrating adaptation into EU external actions*. Likewise, specific targets have been set by the UK Government on climate change and development (Box 1)⁴. The Government's Office of Climate Change is further charged with improving coordination of strategy and policy on domestic and international climate change.

Box 1: UK Government targets for climate change response and development

The UK government pledged to support developing countries respond to climate change and other natural resource threats (HM Treasury, 2007a;b). Actions include:

- Establish a UK position on an international climate change framework post-Kyoto 2012 and help determine developing countries needs
- Promote reform of carbon trading systems to assist developing countries;
- Mobilise development agencies to provide technical and financial inputs to tackle climate change;
- Strengthen developing country capacity to adapt to a changing climate including disaster risk reduction;
- Integrate environmental sustainability (for example efforts on water, energy, forestry, biodiversity, and fisheries) into country programme work;
- Support strengthened international environmental governance, in the context of UN reform, to reflect the needs of poor countries.

In addition PSA 4 more generally requires:

- Greater responsiveness of the publicly-funded research base to the needs of the economy and public services;
- Improving the use and management of science and innovation across Government.

³ Total financing to date amounts to ~\$26million which equates to just one week's spending on flood defence in the UK (UNDP, 2007).

⁴ In addition, the Environmental Transformation Fund allocates £800 million to developing countries.

Objectives of this review

The strategy of the 2006 Global Science and Innovation Forum (GSIF) sets out an overarching framework for international collaborative science and innovation. One of the priority areas of the strategy is to apply research to meet international development goals, in line with the UK White Paper *Eliminating World Poverty*. UKCDS is considering a subset of domestic and international research activity relevant to climate change and development sciences. The present review has the following objectives:

- To provide the UKCDS Board with an update of the climate change research activity of each UKCDS member and to inform on existing or potential synergies, gaps and duplications of the research that is relevant to development sciences;
- To make recommendations on maximising the current and future value (knowledge /financial) of the research and how funding might be directed for future programmes;
- To communicate the outcomes and recommendations of the review to the wider stakeholder community.

Having first set the broad context, the following sections will provide a snapshot of UK research investment in climate change and development sciences together with measures of publication output compared with the rest of the world. We next review the research profiles and shared activities of the UKCDS members (see Annex 2 for the methods of analysis). The review also cites aligned activities of other UK organisations, international bodies and partners where appropriate. We then provide an assessment of emerging priorities, opportunities and barriers to coordination. Finally, we offer suggestions for next steps towards developing a programme of coordinated activity.

Complimentary reviews and research strategies

The UKCDS review follows or coincides with several other research assessments. In 2007 The House of Commons Science and Technology Committee undertook an inquiry into the international policies and activities of the research councils. Several recommendations relate to improved cross-Council coordination on international issues. Since the announcement of the inquiry, RCUK have published an International Strategy (2007) which sets out five broad aims including *influencing international research* to achieve poverty alleviation. The Royal Commission has also begun a review on *Adapting the UK to Climate Change*. This clearly has a domestic focus but potentially adds to wider understanding of adaptation options.

Aside from UKCDS, several members have recently refreshed, or are in the process of revising and extending their research strategies:

- Research Councils and Government departments are currently scoping a cross-Council programme, *Living with Environmental Change* (LWEC), to align funds against common objectives (Annex 3).

- The NERC (2007) 2007-2012 Strategy takes account of the 2005 Millennium Ecosystem Assessment, the 2006 Stern review, and the 2007 IPCC Fourth Assessment Report (NERC, 2007). *Enabling society through climate science* is one of eight science challenges identified in the NERC Climate System theme action plan.
- BBSRC are undertaking an internal review and consultation in early 2008.
- DFID are currently preparing a new research strategy for 2008-2013 (due May 2008). Country-level consultations have identified climate change science priorities, as well as ways of improving scoping and delivery research (see Annex 4), and options for improving access and uptake of climate risk information (Wilby, 2007).
- The Wellcome Trust (2007) is reviewing options to begin to address the health impacts of climate change and is planning three Frontiers meetings to explore opportunities.
- The Research Councils' 2008-2011 Delivery Plans set out what will be achieved during the Comprehensive Spending Review 2007.

UK research funding for climate change and development sciences

According to the Environment Research Funders' Forum (ERFF), there are 678 climate change projects within the full set of nearly 6000 projects held on their 2004-05 database (ERFF, 2007). During that financial year, ERFF investment in climate change projects amounted to ~£68million. This is certainly an underestimate of the total UK investment as contributions from other major funders are not included. For example, in 2005 the Wellcome Trust invested £1million in work that was directly related to climate change, and a further £50million on closely related research (e.g., malaria)⁵. Furthermore, the ERFF search criteria will not capture projects outside of the climate change sub-set that have broader relevance to development science.

Supplementary UKCDS codes were used to sub-classify ERFF projects (see Annex 5) acknowledging that much climate change research funding serves a "global good" for both developed and developing regions alike (Figure 1). Research into global water scarcity is an example of this type of activity. Other research funding has a far more regional focus by virtue of the field sites employed or domains used for modelling. Where it was possible to discern from the project title, aims or objectives, research with a regional emphasis was allocated by region (Africa, Asia, South America, UK, and Other).

⁵ Work directly related to climate change includes projects with "climate change" in the title, and those relating to heat, UV and migration. Over a five year period, the Trust has spent approximately £6 million on directly related research, and approximately £175 million on closely related research, including malaria and dengue.

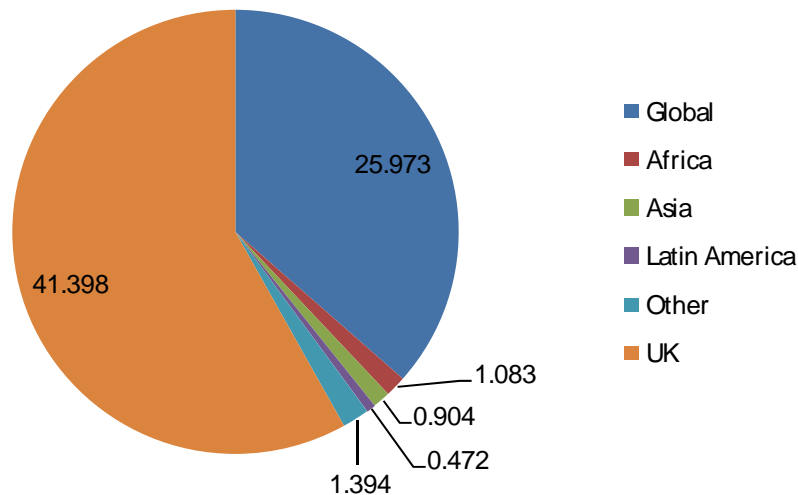


Figure 1 Allocated resources (£million) by geographic scale or region of interest for all climate change projects held in the ERFF 2004-05 database.

Recognising that there is some double-counting (when for example a project has relevance to more than one region), it was found that 58% of funding was allocated to UK-focused projects, 36% to global-scale issues (albeit often with a UK remit), ~4% to developing regions (Africa, Asia or Latin America), and ~2% to other areas. Of the resource allocated to developing regions, 44% was directed at Africa, 37% at Asia and 19% at South America. Clearly, additional benefits accrue to these regions from some of the ‘global good’ projects through, for example, improved monitoring, regional climate change projects, new technologies, and so on. Investments by NGO’s, foundations or the private sector are also excluded. Hence, the investment reported in Figure 1 is a conservative estimate for the three developing regions.

Only 16 projects in the ERFF database were explicitly directed at developing countries (Table 1). The combined spend on these projects in 2004-05 was ~£1.1million, less than 2% of the total UK spend on climate change research. Amongst the 16 development projects, 1 was classified as pure basic research, 9 as orientated basic, 5 applied strategic, and 1 applied specific research. The primary purpose of the research was general support (8 projects), policy support (6) and government services (2). The majority were concerned with either energy use (8 projects), followed by natural process (3).

Funder	Project title	Region
NERC	<ul style="list-style-type: none"> • <i>African Monsoon Multidisciplinary Analyses - UK (AMMA-UK).</i> • <i>To develop a sustainable agroforestry system of staple food production for the Sahel and east African Highlands (ENRICH)</i> • <i>AMMA-NERC</i> • <i>AMMA-EU</i> 	Africa
DEFRA	<ul style="list-style-type: none"> • <i>Climate Change Impacts on Chinese Agriculture</i> • <i>Regional impacts: bilateral with India</i> 	Asia
DFID	<ul style="list-style-type: none"> • <i>Snow and glacier aspects of water resource management in the Himalayas (SAGARMATHA)</i> • <i>Impact of climate and sea level change in part of Indian sub-continent (CLASIC)</i> 	
DEFRA	<ul style="list-style-type: none"> • <i>Brazilian proposal</i> 	Latin America
DFID	<ul style="list-style-type: none"> • <i>Renewable Energy for Sustainable Rural Livelihoods (RESURL)</i> 	
ESRC	<ul style="list-style-type: none"> • <i>Institutions, multi-level collective action and social capital in conservation</i> 	
DFID	<ul style="list-style-type: none"> • <i>Enabling urban poor livelihoods policy making: understanding the role of energy services.</i> • <i>Climate change and the poor: Linking local adaptation needs to policy and institutional structures</i> • <i>Climate change and development</i> • <i>Vulnerability of fisher-folk living in poverty to climate change</i> 	Various
ESRC	<ul style="list-style-type: none"> • <i>Justice in Adaptation to Climate Change: A Strategic Assessment</i> 	

Table 1 ERFF projects identified as directly relevant to development science (in 2004-05).

Some progress has been made since 2004-05. For example, over 2006-2011 DFID will contribute £24million to the Climate Change Adaptation in Africa (CCAA) research and capacity development program (led by the Canadian International Development Research Centre). The 2007 DFID Research Strategy consultation invited comment on ways of improving research into the impacts of climate change on poverty and environmental change (see Annex 4). Ongoing scoping of the LWEC programme represents a further opportunity for alignment of significant resources to applied research in climate change and development science.

UK research output in climate change and development sciences

The focus of this section is on research *output* as measured by peer reviewed publications. Overall, the UK publishes 9% of all research papers (despite having only 1% of the world's population) and UK scientists attract over 12% of all citations to published output. The UK also publishes 13% of papers in journals with the highest impact (FCO, 2006).

Analysis of the Web of Science (WoS) archive indicates that publication output addressing aspects of climate change in developing regions has increased dramatically over the last decade (Figure 2). Actual totals will be larger because much applied development science is published in grey literature and professional journals which are not captured by the WoS. Although the volume of published work

has been growing across other disciplines, it is reasonable to speculate that milestone events such as publication of the MDGs in 2000, or the G8 Gleneagles summit in 2005, have contributed to the underlying trend.

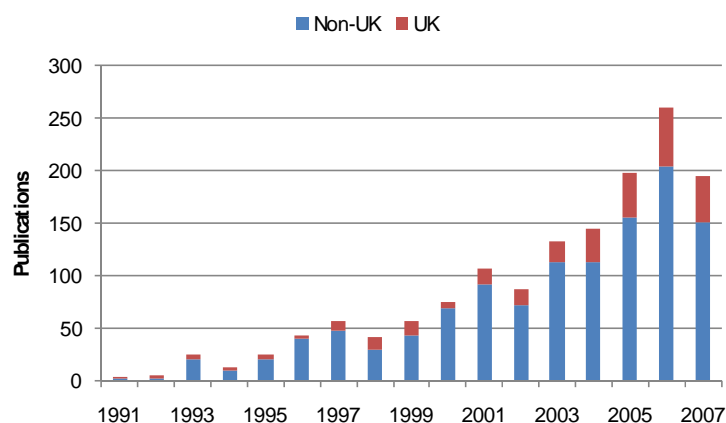


Figure 2 Annual scientific publications for Africa, Asia or South America on the topic of climate change attributed to UK and non-UK authors. Note that 2007 data are incomplete.

The WoS search was far from exhaustive as country-level publications would not necessarily be sampled by the continental descriptors. Nonetheless, the sample contains approximately 1500 entries with the keywords “climate change” and Africa (or Asia or South/Latin America). The UK share of publications was ~21% in the 5-years 2003-2007, compared with ~17% in 1998-2002 and 1993-2001. So the 'market share' is growing and well above the average for all disciplines demonstrating the UK's dominance in the climate change research arena.

Stratifying by author affiliation, continent and/or key word highlights areas of activity with more or less than expected representation. There is a preponderance of UK authors in publications dealing with Africa, less so for South America, and even less for Asia (Table 2). Citation rates for publications with at least one UK author are higher than those for the rest of the world in all continents except South America. The relatively small numbers of UK publications for Asia are, on average, well cited.

Continent	Authorship		Citations	
	UK	Non-UK	UK	Non-UK
Africa	189 (22)	679	13.7	11.0
Asia	80 (16)	411	22.8	15.0
South America	56 (19)	243	14.9	16.2

Table 2 UK and non-UK authored publication and citation rates since 1991 by continent. (Figures in brackets are percentage by UK authors). All languages were searched.

A keyword analysis reveals very few publications addressing aspects of climate change adaptation or mitigation in developing countries, regardless of authorship (Figure 3). Much more work has, to date, addressed climate change impacts, with UK authors making a significant contribution in terms of the proportion of outputs.

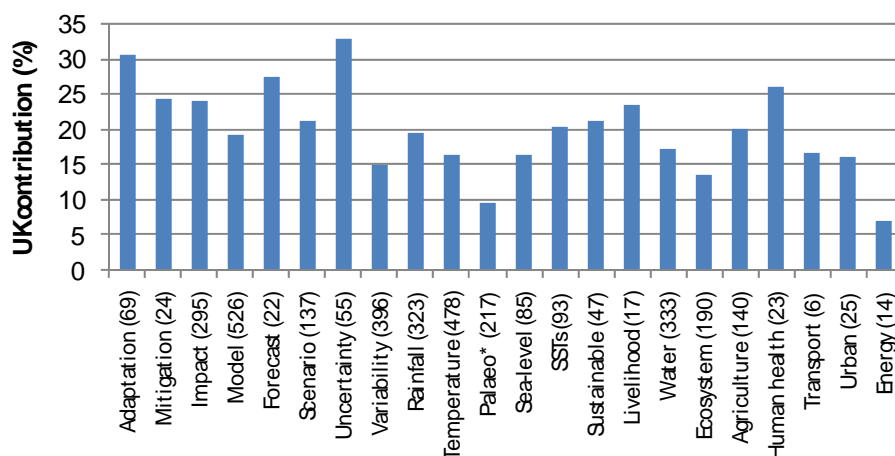


Figure 3 Percentage contribution of UK authors since 1991 by keyword (total sample size is shown in brackets). Note that double-counting (due to inclusion of more than one keyword in a single paper) inflates some totals by up to 10%.

Modelling and some secondary impacts have relatively high volume, but output on forecasting and uncertainty is low (just 22 and 55 papers respectively). Aspects of climate variability and change have received much attention, suggesting that much activity has addressed the physical processes of the climate system (past, present and future). Temperature has been investigated more than rainfall and sea level change. Water is the most favoured sector, followed by ecosystems and agriculture. UK authors have contributed disproportionately to the emerging human health literature (although the sample size is small). Key terms such as “livelihood”, “urban”, “energy” or “transport” appear very seldom regardless of authorship or region of interest.

Counts of lead and contributing authors in the IPCC Fourth Assessment Report provide another crude measure of the UK standing in the global science effort on climate change. UK authors were second only to the USA in terms of numerical prominence in the reports (Figure 4). Across the three Working Group, UK representation was greatest (13% of authors) in the report on *Impacts, Adaptation and Vulnerability*, and lowest (4% of authors) in the report on *Mitigation of Climate Change*.

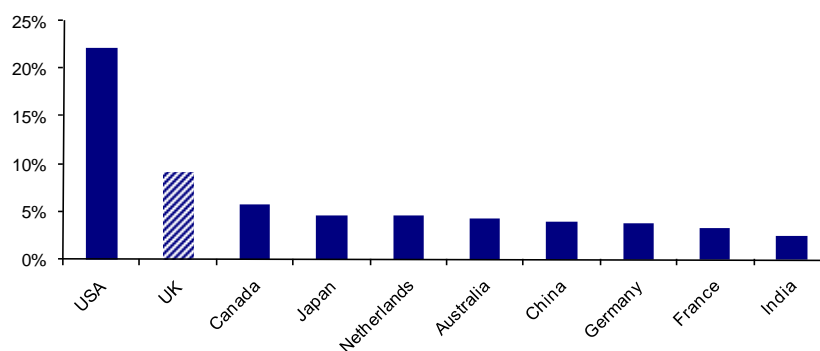


Figure 4 Origin of authors contributing to Working Groups I, II and III of the IPCC Fourth Assessment Report. Dual nationality authors were excluded from the analysis.

Research activities of UKCDS members

The following sections provide a synthesis of consultations with UKCDS members rather than an organisational report. A list of key informants is provided in Annex 6.

The findings are organised by high-level objectives and outcomes, shared activities, emergent themes, opportunities and barriers.

High-level objectives and assessment of outcomes

The Government's PSAs (Box 1) set the strategic objectives for the UK and provide a clear mandate for work on post-Kyoto emissions agreements, carbon trading schemes, disaster risk reduction, environmental sustainability and governance in developing regions (Annex 1). The forthcoming Climate Change Bill could impact on developing countries through changes to carbon markets and investment administered through the Clean Development Mechanism (Annex 7). The UK Sustainable Development Strategy also has an international dimension.

Although the international effort to combat climate change is recognised as a key scientific challenge by members, historically, research funding has been largely UK-focused (as evidenced by Figure 1). Other high-level objectives cited by members, include:

- Undertaking high quality innovative research that impacts scientific debate and policy on climate mitigation and adaptation;
- Maximising opportunities for international coordination and capacity building;
- Tackling priority themes in agriculture, health and governance;
- Developing interdisciplinary links to improve transfer and use of climate information;
- Improving understanding of climate change impacts and adaptation solutions;
- Improving operational effectiveness and evaluation through cooperation and sharing of best practice.

Progress is being measured against the above objectives via:

- Conventional performance indicators (under PSA 4), such as high-quality, peer reviewed scientific literature, patents, conference proceedings and PhD training;
- Levels of stakeholder engagement in grant proposal, project advisory and appraisal;
- Independent reviews of joint programmes by panels of international experts, evaluation workshops and questionnaires.

Some see success in broader terms such as a step change in behaviour on global emissions in the run up to 2012, or evidence-based development policy, and assessment of "dangerous" climate change. Several respondents commented on the difficulty of measuring programme *outcomes* (such as progress made against the Millennium Development Goals) - a point that has emerged in wider scientific debate (Nature, 2007a). Others ensure that each project has specified outcomes that can be evaluated by beneficiaries. Most recognise the need to commission research on procedures and metrics for evaluating outcomes.

Shared research activities and resources of UKCDS members

Key informant interviews were used to map the portfolio of coordinated activities and shared resources within the UKCDS membership (Figure 4). The matrix is intended to show the range of topics and types of recent activity; it is not an exhaustive analysis. Furthermore, bilaterals involving a *single* UK partner are not shown, though some may involve substantial contributions on the part of the UK (for example, DFID's CCAA program with IDRC). With these boundaries in mind, the mapping reveals the following types of activity (colour coded in Figure 4):

- **Joint research programmes** (e.g., Environment and Human Health; Rural Economy and Land Use; Ecosystem Services and Poverty Alleviation);
- **Shared infrastructure costs** for offices, institutes and laboratories (such as the Tyndall Centre and MRC laboratories in Gambia and Uganda);
- **Networks**, concordats and advisory groups;
- **Jointly funded country-specific research** partnerships (on agriculture, forecasting, human health);
- Research partnerships for climate modelling and earth observation;
- **Capacity building through overseas fellowships and secondment schemes.**

Gaps in the matrix are equally informative. At first glance, there is little evidence of engagement by the newly formed Department for Innovation, Universities and Skills (DIUS). However, DIUS plays a different role, for example, coordinating the recent response of the House of Commons Science and Technology Committee review of the Research Council's international policies and activities. DIUS is also charged with *developing a common mechanism for the systematic collection of data on international collaborations and to develop ways of assessing their performance in this field*⁶. DIUS also has to ensure that *relationships with other countries are exploited at all levels* (HC STC, 2007) through support for bi-lateral contacts and networking schemes.

It is also helpful to consider how much emphasis is being placed on climate change science, development science, or both. The Defra-NERC Japanese Earth Simulator project is an example of climate science that contributes to global good (e.g., World Bank, 2007a). At the other extreme, the DFID-MRC DART project is undertaking multi-country HIV treatment trials in Africa. At face value this is not climate change science, but there are clear links between the incidence of infectious diseases and capacity to adapt to climate change (WRI, 2007).

Very few projects explicitly address climate change risks *and* development as in the case of Defra-DFID international action in China and India, or WTs work on environmental change and the epidemiology of malaria in Africa. However, climate-development science is not yet undertaken at programme level by any UK partnerships.

⁶ The 2007 R&D Scoreboard (DIUS, 2007) reports most rapid growth in UK research investment in telecommunications, pharmaceuticals and biotechnology. Key terms such as "climate change", "renewable [energy]", and "carbon" are conspicuously absent.

Figure 5 Map of shared resources and interactions amongst UKCDS members that address climate change and/or development science.

	BBSRC	Defra	DFID	DH	DIUS	ESRC	MRC	NERC	WT	Others
Defra	a,b,c									
DFID	d	h, i								
DH										
DIUS		j								
ESRC	c,e,f		m,n,o,p							
MRC	c,f		n,p,q	v						
NERC	c,b,f	j,k,l	m,r,s		j	w,x				
WT	c		p,t,u				y,z			
Others*	c,f,g	j,k,l	t			w	y	s,aa,bb		

* UK and joint overseas activity

Key:

- a. Shared infrastructure costs of research institutes
- b. Soils Research Advisory Committee and workshop
- c. Environment and Human Health Programme (with EA, EPSRC, MOD and HPA)
- d. Co-funded development work in crop science/ sustainable agriculture
- e. Rural Economy and Land Use Programme (RELU)
- f. Brussels UK Research Office on behalf of all Councils
- g. Joint laboratories in China addressing crop genetics, pest control and soil science
- h. Country Assistance Action Plan addressing climate change impacts of Chinese agriculture
- i. PRECIS regional climate modelling system (also with FCO and UNDP)
- j. Influencing content and uptake of EU FP7 Environment (including Climate Change) Theme
- k. Climate modelling partnership involving Japanese Earth Simulator
- l. Earth observation research (with DTI and MoD)
- m. Programme on Ecosystem Services and Poverty Alleviation
- n. Concordat on development research in Africa
- o. Programme on Poverty Alleviation
- p. Health Funders' Forum
- q. Development of Antiretroviral Therapy in Africa (DART)
- r. European Union Water Initiative (EUWI) ERA-NET
- s. Overseas secondments of NERC Research Centre scientists
- t. Medicines for Malaria Venture (MMV) (with World Bank, Swiss Agency and others)
- u. Health Research Capacity Strengthening Initiative; Kenya and Malawi (with IDRC)
- v. Concordat including research on global health
- w. Tyndall Centre for Climate Change Research (also with EPSRC)
- x. Projects on climate change, ozone and human health
- y. Laboratories in Gambia and Uganda engaging with various international bodies
- z. Overseas fellowship schemes for clinical and non-clinical research
- aa. India Monsoon collaboration via UK India Education and Research Initiative (UKIERI)
- bb. Country-specific activities through Joint Commissions (with FCO and OSI)

Research activities of other organisations

Integration of climate risk information in adaptation planning is now seen as a priority by international donor and environmental agencies alike (DFID, 2005; World Bank, 2006; 2007b; EEA, 2007). The World Bank recently estimated that ~40% of its development portfolio is climate sensitive, but only 3% had made explicit provision for climate change. Similar degrees of exposure have been identified by the Organisation for Economic Co-operation and Development (OECD) for development agencies across Europe. Other international bodies such as WHO are scaling up research related to climate change, through a new *Global Strategy on Health Protection from Climate Change*, and by incorporating climate change in the forthcoming WHO health research agenda.

The EU Green Paper envisages enhanced dialogue and financial cooperation between the EU and developing countries via a Global Climate Change Alliance (GCCA) (EU, 2007b). Five priority areas are identified by the GCCA strategy, including support for adaptation action plans, improving preparedness for climate-related natural disasters, and integrating climate change into poverty reduction efforts. The activities will be financed via the EC Thematic Programme *Environment and Sustainable Management of Natural Resources, including Energy* to the tune of €50 million. An additional €250 million may be accessed via aligned funding under the EU *Action Plan on Climate Change and Development*, and €100 million earmarked for Disaster Risk Reduction. Furthermore, the EU seventh Framework Programme also makes provision for scientific collaboration with non EU countries.

Some UK agencies have established direct links with counterparts in developing regions under the international remit of the UK Sustainable Development Strategy. For example, the Environment Agency's "practitioner-to-practitioner" capacity building is funded by the Commonwealth Professional Fellowship Scheme. More generally, there is a need for a unified strategy for capacity building⁷ at all levels in the UK and overseas, taking forward the recommendations of the House of Commons Science and Technology Committee (2007) and the UK Research Councils (2007). Specific suggestions include the call for the formation of a Global Science Corps for climate change and development (TWAS, 2006).

Charitable foundations and organisations are a further source of funding for work on climate mitigation (especially in renewable energy, new technologies), climate impacts and adaptation (especially human health dimensions) (Table 3). Many such programmes command resources on scales equal to or exceeding those of research councils and government departments. However, foundations may lack established networks for delivery, so there could be significant opportunities for partnership through existing channels.

⁷ Separate UKCDS work streams are analysing the issue of capacity building, and horizon scanning, in more detail.

Foundation	Example activities
Bill and Melinda Gates Foundation	Global Health programme addressing human health issues, and a Global Development programme with initiatives on agriculture, water and sanitation
Foundation for the Protection of the Environment	£12 million to establish an Institute of Climate Change at Imperial College London
Google Foundation	Focus on transformative technologies to cut greenhouse gas emissions, with some initiatives to “help the most vulnerable groups in developing countries adapt to climate change”
Kohn Foundation	£1 million to support climate change policy research in the Royal Society Science Policy Centre
Leverhulme Trust	Climate change related response-mode grants
Rockefeller Foundation	Climate Change Initiative to “catalyze attention, funding, and action in building climate change resilience for poor & vulnerable people globally”

Table 3 Examples of charitable foundations and organisations funding work on climate change in developing regions.

The private sector increasingly recognises the potential risks and opportunities posed by climate change. For example, some insurance companies have been devising new products and services for emerging markets in the developing world (Mills, 2007). Swiss Re (2007) are now offering micro-insurance backed up by climate modelling and remote sensing of severe drought conditions and food scarcity in parts of Kenya, Mali and Ethiopia. Munich Re (2007) is leading the *Munich Climate Insurance Initiative* to identify insurance solutions, conduct pilot projects and education within the industry⁸.

Several NGOs mounted high profile campaigns on climate change and aspects of development in the run up to the COP13 in Bali. For example: Oxfam (2007) reminds of the growing risk from extreme weather events to the world’s poor; the New Economics Foundation (2007) highlights the growing threat from climate change to human development in Asia; the World Resources Institute (2007) provides a compendium of adaptation cases; Friends of the Earth (2007) call for a global movement to assure climate justice; and the World Wide Fund for Nature (2007) recently challenged the integrity of the Clean Development Mechanism.

Emerging research priorities

In reviewing research priorities, UKCDS has deliberately avoided a thematic approach where knowledge gaps are brigaded along traditional disciplinary lines. Instead, we have approached the task from the perspective of desired outcomes, as set out in the MDGs. In other words, defining what research is needed to accomplish poverty alleviation in the face of climate change.

⁸ Note that the World Bank and UN World Food Program already employs weather indices to trigger payouts in the event of weather disasters or collapses in commodity prices.

As noted above, several UKCDS members are themselves undertaking portfolio mapping and horizon scanning. Alongside the present consultation, three “rallying points” or synergies are beginning to emerge:

- **Improving access to and uptake of climate risk information** – is a priority for both suppliers and users of climate change scenarios. A recent review on behalf of DFID (Wilby, 2007) identified four priority areas:
 - **Monitoring and data** – to fill gaps in observing networks and data collection; provide essential inputs for long-term forecasts and track environmental changes; preserve and improve access to threatened records; contextualise climate risks alongside co-stressors; and demonstrate the value of climate risk information.
 - **Basic science** – to build understanding of the physical processes driving regional climate variability and change; improve knowledge of local controls on climate due to land-cover change, or of impacts in urban, mountain and coastal environments; and better characterise key sources of uncertainty affecting decadal climate forecasts.
 - **Decision support** – to improve access and sensibility of climate risk information for regional and country-level adaptation planning; put in place online data portals and supplementary information; develop screening, visualization and decision-support tools; offer guidance for practitioners on tool selection and appropriate use.
 - **Human capital** – to foster in-country training of the next generation of climate change scientists; strengthen the interface between suppliers and users of climate risk information; support accredited professional development schemes; assist countries to develop sector specific adaptation guidance; strengthen capacity in climate science coordination and advocacy.
- **Addressing impacts of climate change on human well-being** – is high on the agenda of several UKCDS members, research councils and NGOs. This is broader than human health *per se* and has strong links to water, food and energy security (e.g., Wilkinson et al., 2007) and brings together climate risk and vulnerability assessment:
 - **Extreme weather events** – to address the direct public health effects of heat waves, droughts and extensive flooding (e.g., physical injuries or mental health), as well as indirectly through water and/or food scarcity and malnutrition.
 - **Emerging diseases** – to prepare for changes in the distribution of vector-borne diseases, such as malaria and dengue, rodent-borne and water-borne diseases, as well as emergent diseases in crops and livestock.
 - **Population displacement** – to prepare for migrations forced by rising sea levels, water and food scarcity, to urban areas and slums, to meet future energy, water and sanitation needs.

- **Food and water security** – to develop new cultivars, sustainable agriculture and water solutions, and balance with competing demands for bio-fuels, carbon and biodiversity management.
- **Establishing baselines and measuring intervention outcomes** – is widely recognised as a priority issue (see for example Nature, 2007a;b). Outcome mapping may be quantitative or qualitative but requires:
 - **Reversing the decay of surveillance networks** – to enable development of basic climate risk indicators (for the reasons noted above), including human epidemiology and environmental change monitoring.
 - **Reliable poverty indicators** – to benchmark progress against the MDGs, taking into account the confounding effects of regional climate change.
 - **Scientific evaluations of interventions** - to measure the effectiveness of behaviour changes, and cost effectiveness of policies, especially at the sub-national scale, hence identify best practice and formulate guidance.
 - **Revising reward structures** – to incentivise the scientific community to focus more on alleviating poverty and its impacts than on patents and papers.

The above options provide a coherent programme of work for improving access to climate risk information, focusing on (human well-being) outcomes, and measuring the success of interventions. Capacity, behaviour change, governance and equity issues cut across the three layers of activity (Figure 6). The themes also map well to the priorities of the GCCA, draft objectives of LWEC (Annex 3), and a preliminary trawl of feedback from the DFID consultation (Annex 4).

Capacity	Behaviour	Equity	Climate risk information	DFID?	LWEC?	EU?
			Human well-being			
			Intervention outcomes			

Figure 6 Conceptualisation of the three component programme, cross-cutting themes, and mapping to initiatives.

Opportunities and barriers

Key informant interviews and members’ research/policy strategy documents help identify the following opportunities and barriers shaping options for future programmes.

Opportunities

Several strategic opportunities emerge at international, governmental, departmental, research council and researcher levels. The following options could add value:

- Incorporate agreed climate change and development science priorities within a single research programme, such as the evolving research framework of LWEC (human well-being issues are prominent in draft objectives A to D, see Annex 3).
- Inform programme development by the country-level views expressed in the recent DFID R4D consultation (Annex 4) and thereby strengthen stakeholder engagement.
- Work with the GSIF to develop a coherent strategy for capacity building at all levels (government, donors, research programmes, country offices, end-users).
- Strengthen existing partnership agreements (such as between NERC, Defra and the Met Office) to maximise synergies and coordinate shared research interests.
- Sustain and extend bilateral agreements between the UK and research partners in India, China, and Africa.
- Share information on funded work by establishing common databases and searchable archives.
- Align and lever additional resources from EU programmes administered through the GCCA, and FP7.

Barriers

The following were identified as barriers to improved coordination:

- Resource (non-manpower/ manpower) issues were, not surprisingly, the most frequently cited constraint. This includes resources for project management, ongoing technical support and delivery of tools (such as PRECIS) beyond the scientific development phase. Some members suggest that longer/larger research grants are the solution.
- The large number of players can present a bewildering landscape of roles and responsibilities. For example, it is unclear which government department should take the lead on tackling the global decline in observing networks (the Met Office has some country-level responsibility). Lack of progress since the Gleneagles G8 commitments to strengthen meteorological monitoring capacity, especially across Africa, hamper research and development at all levels.
- In the absence of coherent research programmes on climate change, adaptation and development, much work has been undertaken in a piecemeal way at project-level, increasing the risk of duplication with other funders, or diffusing effort.

- Technical capacities are lacking at all levels and in key skill sets such as economics (bridging development and environmental sub-disciplines) and science translation. Many target countries have insufficient capacity to absorb project funding or to scale up activities.
- The existing reward structure (based on publications and patents) does not incentivise the inter-disciplinary research needed to address climate change-adaptation and development challenges. Furthermore, research institutes have a long single science “tradition” and incentives may be lacking for cooperation between centres of excellence.
- Government departments in the UK are downsizing yet being asked to do more at the same time. There are opportunity costs and risks associated with diverting finite resources from existing activities to climate change.

Preliminary conclusions

This review has taken stock of the level of resource allocation to climate change and development sciences. Estimates based on available data for 2004-05 suggest that research directed at developing regions amounted to less than 2% of total ERFF spend on climate change science. To date, most work has been project- rather than programme-based, leading to a diffuse approach. Some progress has been made since 2004-05 in terms of international collaborations and efforts to coordinate activities bi- and multi-laterally within the UK. Furthermore, the international agenda is rapidly evolving as evidenced by new initiatives announced at the COP13 in Bali (e.g., research to look at the costs of adapting to climate change supported by the UK, Netherlands and World Bank).

Despite historically low levels of funding, UK scientists have contributed disproportionately to knowledge generation. According to conventional performance metrics, the volume of published work by UK authors is increasing, as is market share and citation rates. However, it is recognised that the international research output on climate change and development themes is very low, but growing.

Scientific publications by UK authors are most numerous for Africa. The most favoured sectors (by volume) include water (resources and flooding), agriculture and ecosystems. The most prominent topics (in terms of UK market share) include adaptation, forecasting, uncertainty, and human health. Topics with relatively little published work (regardless of author affiliation) include impacts on urban, transport, and energy sectors. Therefore, even modest research investments targeted at these areas could yield disproportionate benefits in terms of UK market share.

The consensus emerging from key informant interviews is that future research programmes should deliver improved access to and uptake of climate risk information; promote human well-being as a core objective; and be measured in ways that incentivise outcomes-based research.

Recommendations⁹

The following options are based on evidence gathered by the UKCDS review and knowledge of complimentary activities elsewhere:

1. **Initiate a process to develop a coherent programme of research.** Identify a Working Group (WG) as a mechanism to improve coordination between members' research programmes, consolidate capacity building efforts, and align with international initiatives e.g., GECC/UKCDS, and link to LWEC. The WG could include representatives of UKCDS members, plus other government bodies (FCO, EA, MoD).
2. **Map each WG members' research programme to an agreed set of objectives.** For illustrative purposes only, research priorities were drawn from DFID's consultation exercise and mapped to LWEC's draft strategic objectives. A coherent research framework would satisfy one of the key recommendations of UNDP (2007) that donors should move from project- to programme-based financing.
3. **Broaden the present analysis to include charitable foundations, NGOs and the private sector (e.g., insurance, energy, pharmaceutical).** This recognises that new players are entering the climate change arena and many have substantial research resources at their disposal. It is also important to ensure that private and public-sector research investments are optimally aligned.
4. **Identify and inform UKCDS members of funding opportunities within existing or new programmes.** There are opportunities to align the UK climate change and development science programme (in #2) with international initiatives using existing frameworks such as GSIF. Also to establish collaborative ventures with the EU GCCA and through the CAAST-NET (Coordination and Advancement of sub-Saharan Africa-EU Science and Technology Cooperation Network) to the EU FP7.
5. **Look at strategic options for incentivising outcomes-based research in the UK.** The forthcoming 2008 RAE consultation provides a timely opportunity for UKCDS members to submit suggestions. In parallel, to establish scientific evaluations and metrics to assess the cost-effectiveness, duration and scale of benefits of research-led interventions to alleviate poverty.

⁹ Next steps are being developed in more detail following inputs from UKCDS members.

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Annex 1 Equity – a common but differentiated responsibility

Rising to the challenge posed by climate change will require concerted and coordinated action to reduce greenhouse gas emissions. The chairman of the IPCC summed up the scale of the challenge at the launch of the 4th IPCC synthesis report (Box 2). Others have highlighted the lack of progress and financial commitment on the part of rich nations to assist adaptation capacity building in the developing world.

Box 2: Perspectives

“In the immediate future it will not possible for developing countries to reduce carbon dioxide emissions; what we can reduce is the rate of growth in emissions and attempt to move along` a trajectory in increase of emissions of greenhouse gases that is much lower than what has been established by the developed world... Developed countries must reduce emissions in the immediate future. The challenge for developing countries will be to work for a lower carbon intensive rate of growth but in order to remove poverty and reach the level of wellbeing that everybody aspires to today emissions will increase for some time” (IPCC Chairman, Rajendra Pachauri)

“Expressed in diplomatic language, the international response to adaptation has fallen far short of what is required...Total financing to date has amounted to around US\$26million – a derisory response. For the purposes of comparison, this is equivalent to one week’s worth of spending under the United Kingdom flood defence programme” (UNDP Human Development Report, 2007)

Key to the IPCC message is that *technology and capacity transfer* are needed to both decrease greenhouse gas emissions in developed countries and to limit the rate of growth of emissions in developing countries. The IPCC reports provide the evidence-base that underpins the coordinated high-level policy responses necessary for action on climate change mitigation and adaptation (IPCC, 2007). The IPCC found that assessed stabilisation levels can be achieved by the adoption and scale-up of a set of technologies that are either already available or expected to be on the market in the next decades.

In order to adapt to climate change, governments must understand the extent to which they may be exposed and take steps to reduce vulnerability of the most exposed sectors and populations (Huq et al., 2006). Capacity and resource transfers will be critical in adequately supporting developing countries embed climate change adaptation within national development strategies, tackling both the short-term shocks and long-term risks associated with climate change (IDS, 2007). For timely and effective mitigation and adaptation to occur, the IPCC warned that appropriate and effective incentives must be created. Relevance to the UK funding and research environment is three-fold:

- First, there is a need for further research on the impact of climate change on environmental, economic, social and health dimensions,
- Second, new technologies need to be supported throughout their lifecycle, from research and development through to implementation and scale-up
- Third, there is a need to support the mainstreaming of climate change into development policy, ensuring that social protection mechanisms are in place to enhance the adaptive capacity of the most vulnerable.

Annex 2 UKCDS review methodology

The review combined an analysis of primary and secondary data on the recent and planned climate change–development research activities of the UKCDS members. We also considered research programmes outside the UKCDS membership, both in the UK and internationally¹⁰, to contextualise the activities of UKCDS members.

International research profile

In order to further assess the UK contribution to research on climate change and development, keyword searches were conducted using the ISI Web of Science (WoS). The volume of scientific output and citation rates were sampled for articles since 1991 attributed to UK and non-UK authors. Articles were analysed by continent (Africa, Asia and South America), and by key descriptors (such as impacts, adaptation, mitigation). All articles contain the term “climate change” in either the abstract or title. Publications attributed to the UK include at least one author from institutions in England, Wales, Scotland or Northern Ireland; author order was not taken into account. Statistics were compiled using data available on 31 October 2007. The WoS analysis was supplemented by a survey of UK and non-UK authorship in the IPCC Fourth Assessment Reports.

Research funding

In order to gain a snapshot of UK research funding on climate change and development, the Environment Research Funders’ Forum (ERFF) 2004-05 database was interrogated for climate change projects with a development aspect. Ten of the twelve priority areas in the ERFF report are defined only by using combinations of codes from the main classification scheme, without keywords. The climate change query definition includes the five codes listed in Table A5.1 (Annex 5) as well as the keyword K16. This was deemed necessary by the funders to better reflect the overall level of activity in climate related science.

The current ERFF classification system does not enable selection of projects by geographic region, and there are no specific descriptors or keywords applicable to “development” science. Table A5.2 (Annex 5) illustrates the difficulty of extracting projects with a human development dimension from the climate change subset. Therefore, an additional set of codes were used to classify all climate change projects by geographic scale and/or region(s) of interest (Table A5.3), and a new keyword K17 was assigned whenever human development is explicitly mentioned in the project objectives or description.

Interviews

Key informant interviews were conducted with representatives of both policy and research dimensions of UKCDS member (where possible). The interviews gave an overview of the climate change research activity of each UKCDS member and helped to identify existing or potential synergies, opportunities, and barriers to research with respect to development sciences (Box 3). Where available, data on the financial value and duration of research funding provide indicators of commitment and priority compared to total research budget spend.

¹⁰ Such as the Living with Environmental Change (LWEC) programme, European Union, the United Nations, World Bank, charitable foundations and NGO’s.

Box 3: UKCDS Key informant interviews

In-depth interviews captured contextual information by exploring the following themes:

Intended outcomes:

- Establish the high-level objectives of each programme
- Compile metrics of programme outcomes

Existing profile:

- Take stock of existing activities of each UKCDS member
- Identify shared resources (such as data bases, infrastructure, institutes)
- Gather evidence of cross-cutting activities, synergies and duplication

Research trajectories:

- Describe methods used to engage stakeholders in research design
- Review emergent themes and future research priorities
- Identify key constraints and risks

Finally, a summary matrix of joint research activity was constructed using evidence drawn from interviews, strategy documents and web-based sources. This reveals the breadth of co-funded research activity and nodes of shared research interest, as well as highlighting areas with relatively low levels of coordinated activity.

Annex 3 Draft LWEC strategic objectives. Human health and well-being outcomes are highlighted in **bold**. Note the objectives are still under review (December 2007).

Objective A

To build effective mitigation, adaptation and resilience to climate change, including preparedness for changes to the intensity and frequency of extreme events, so that **human well-being** and health are ensured through sustainable and socially acceptable environmental management including the introduction of technological solutions to environmental problems.

Objective B

To assess the links and feedbacks between natural resources, ecosystem services and **human well-being**, how this might continue to develop within environmental limits in the face of major environmental change, and how decision-making and national planning needs to take account of these links and feedbacks so as to develop new social and economic opportunities.

Objective C

To promote **human well-being**, alleviate poverty and minimise waste by developing sustainable ecosystem management approaches for safe and secure food production and water supply.

Objective D

To protect **human health** by predicting how diseases hazards and other environmental factors will alter under forthcoming environmental change scenarios, assessing which sectors of society are most at risk and determining what management actions need to be taken.

Objective E

To make infrastructure, the built environment and transport systems resilient to environmental change and develop more sustainable less energy-intensive systems and approaches that are socially acceptable, economically advantageous and more environmentally harmonious.

Objective F

To work with the diverse communities of the UK to understand how, on the basis of their cultural backgrounds and belief systems, they live with their environment at present and how this is likely to develop as the environment changes so as to facilitate the growth of more cohesive communities that live with their environment more empathetically through a process of behavioural change in which all citizens are engaged.

Objective G

To help introduce technological solutions to the problems arising from the current way energy is generated by assessing the environmental capacity and acceptability of renewable forms of energy and promoting innovation in a) ways of supplying energy and heat and b) removing GHGs from the atmosphere.

Annex 4 Draft climate change research priorities emerging from DFID's R4D country-level consultation, and broader feedback on ways of improving scoping and delivery of research. For illustrative purposes only options have been mapped to draft LWECC objectives [**letters in bold**] (see Annex 3). * denotes if expanded to include communities outside the UK

Mitigation

- Assess the impact on rural and urban food security of bio-fuels caused by change of use from food commodity or switch of production to non-food crops [**B**]
- Research determinants of behaviour change on transport and energy use (also for uptake of adaptation measures) [**F***]
- Understand social and cultural norms and values that shape attitudes to natural resource consumption [**F***]
- Identify land use systems that are maximise carbon uptake and production [**G**]

Impacts

- Assess links between emerging diseases and climate change [**D**]
- Use Earth observation to monitor impacts of all human development signals [**B**]

Adaptation

- Develop cultivars that are better suited to changed climate conditions [**C**]
- Devise techniques for developing, replicating and up-scaling adaptive strategies [**A**]
- Develop low-cost, locally sustainable water and sanitation infrastructure solutions [**C**]
- Provide ancillary data such as up to date land use maps [**B**]
- Manage water usage within the context of wider environmental change [**B**]
- Assess constraints on agricultural communities to long-term adaptation [**A**]
- Develop forecast products that are better suited to the needs of the poor [**A**]
- Develop tools to help mainstream climate change adaptation and disaster risk reduction within donor portfolios [**A**]

Feedback on ways of improving scope and delivery of research

- Engage stakeholders from outset when defining the research problem
- Include the perspectives of marginal groups when setting research priorities
- Support collaborative activities and centres of excellence
- Assess success of research and technology outcomes against poverty alleviation
- Show case best practice examples of effective research-client partnerships

- Strengthen effective institutions, departments and ministries in developing regions
- Establish inter-regional networks in advance of undertaking research
- Provide resources for research resource translation for/by policy-makers
- Involve country offices and their networks in research prioritisation
- Support 'twinning' programmes, training and exchanges with UK universities
- Ensure that end users have the capacity to respond to research recommendations
- Develop early-stage training programmes for young researchers
- Promote open access to all publicly fund research via a range of media

Annex 5 Definition of climate change and development projects within the Environment Research Funders' Forum (ERFF) 2004-5 data base

Table A5.1 EPIC codes used to define climate change projects

Code	Description
E2.2.A.1	Pollution by greenhouse gases
E3.1.1	Climate change and climate change effects
E3.5.3	Inundation of low-lying lands (by rising sea-levels)
E3.6.3	Health effects of extreme weather events, extreme temperatures and climate changes
E4.B.1	Solutions related to climate change and/or supplies of energy and oil-based materials

Table A5.2 An example development project from the ERFF database

Project title	<i>Enabling urban poor livelihoods policy making: understanding the role of energy services</i> (ERFF6654)
Sponsor	DFID
Objectives	To provide a clear understanding, based on micro-level gender disaggregated data, of the issues around urban energy supply and use for poor people's livelihood strategies.
Dimension	#A2 Orientated basic research
Purpose	#B3 ppC Policy support
Drivers	#C16 Non-specific (generic research not related to a specific driver or drivers)
Domain	#D4.1 Troposphere #D5.2.1 Man
EPICS	#E4.A.1 Prevention or reduction of damage to the environment #E4.B.1.3 Non-fossil fuel energy sources #E4.C.4.6 Measurement – other #E4.C.6 Psychological and sociological influences
Keyword	None

Table A5.3 Supplementary codes used to classify ERFF projects by scale and region of interest

Code	Description
U1	Global scale emphasis or common good
U2	Regional scale emphasis or common good
U2.1	Applies specifically to, or is highly relevant to Africa
U2.2	As U2.1 but for Asia
U2.3	As U2.1 but for Latin America
U2.4	As U2.1 but for the UK
U2.5	Other regions (mainly Antarctic, Arctic, Europe, or North America)

Annex 6 Consultation and key informant interview details

Ballance, Anna	Department for International Development
Bartholomew, Marion	Environment Research Funders' Forum
Dukes, Peter	Medical Research Council
Firbank, Les	Institute of Grassland and Environmental Research
Grubb, Gary	Economic and Social Research Council
Hayter, Clive	Engineering and Physical Sciences Research Council
Hedges, Peter	Engineering and Physical Sciences Research Council
Johnson, Cathy	Department for Environment Food and Rural Affairs
Kovats, Sari	London School of Hygiene and Tropical Medicine
Lorenzen, Catherine	Environment Agency
Osborn, Daniel	Natural Environment Research Council
Perrin, Nicola	Wellcome Trust
Pope, Vicky	Hadley Centre
Poulter, Guy	Natural Resources Institute
Seager, John	Environment Agency
Snewin, Val	Wellcome Trust
Sutton, Rowan	Natural Environment Research Council
Willis, Tim	Biotechnology and Biological Sciences Research Council

Annex 7 Climate Change Bill – Extract from the 2007 House of Commons
Environmental Audit Committee

106. *We have concerns as to the scope in the draft Bill for the UK's carbon reduction targets to be partly met by purchasing carbon credits from other countries. The Government must ensure that carbon credits are not used to forestall the early transition in the UK to low carbon infrastructure in power generation, buildings and transport, as this could mean that the country is locked into carbon-intensive lifestyles for decades to come. At the same time, **we certainly recognise the potential importance of trading in providing funds for low carbon infrastructure in the developing world.** We would simply argue that this must not become an "either/or": the Government should ensure that the UK's targets are sufficiently challenging that they drive decisive emissions reductions at home and abroad.*

107. *Where emissions trading is used to meet UK targets, **it is essential that the Government distinguishes clearly between emissions reductions achieved within the UK and emissions reductions funded by the UK but taking place abroad.** Thus far, in reporting the relationship of the EU ETS to UK emissions, the Government has been less than transparent. The problem with this is that it might foster a false sense of complacency about the progress and policies required to decarbonise the UK. The Government ought to adopt a code of practice for reporting UK emissions, and the Committee on Climate Change should audit Government press and statistical releases.*

Annex 8 Health Consequences of Climate Change.

A report by Nicola Perrin, the Wellcome Trust.

Annex 9 Options for Improving Climate Scenarios and Impact Assessment Capacity in Africa, Asia and Latin America.

A report by Rob Wilby, on behalf of The UK Government's Department for International Development.

Due to document size constraints, annexes 8 and 9 have been sent as separate attachments.

Acronyms

BBSRC	Biotechnology and Biological Sciences Research Council
CCAA	Climate Change Adaptation in Africa
Defra	Department for Environment, Food and Rural Affairs
DFID	Department for International Development
DIUS	Department for Innovation, University and Skills
ERFF	Environment Research Funders' Forum
ESPA	Ecosystem Services and Poverty Alleviation
ESRC	Economic and Social Research Council
EU	European Union
FCO	Foreign & Commonwealth Office
GCCA	Global Climate Change Alliance
GSIF	Global Science and Innovation Forum
HC STC	House of Commons Science and Technology Committee
IDRC	International Development Research Centre
IPCC	Intergovernmental Panel on Climate Change
LWEC	Living with Environmental Change
MDG	Millennium Development Goals
MoD	Ministry of Defence
MRC	Medical Research Council
NERC	Natural Environment Research Council
OECD	Organisation for Economic Co-operation and Development
PSA	Public Service Agreement
RAE	Research Assessment Exercise
RCUK	Research Councils UK
TWAS	The Academy of Sciences for the Developing World
UKCDS	UK Collaborative on Development Sciences
UN	United Nations
UNDP	United Nations Development Programme
WoS	Web of Science
WRI	World Resources Institute
WT	Wellcome Trust