Living With Environmental Change

# Climate Science, the Public and the News Media

## Summary Findings of a Survey and Focus Groups Conducted in the UK in March 2011

**Emily Shuckburgh[1], Rosie Robison[2,3] and Nick Pidgeon[4]**

[1] British Antarctic Survey, Natural Environment Research Council
[2] University of Cambridge
[3] Global Sustainability Institute, Anglia Ruskin University
[4] Cardiff University

September 28th 2012

## Acknowledgements

Work presented in this report was jointly funded by the Natural Environment Research Council (NERC), the Met Office, the Department of Energy and Climate Change (DECC) and the Department for Environment, Food and Rural Affairs (Defra), all of whom are active in the Living With Environmental Change (LWEC) Partnership (www.lwec.org.uk). Additional support was provided by a NERC/DECC Policy Placement, an Economic and Social Research Council Climate Leader Fellowship (RES-066-27-0013) and a donation from Howard and Veronika Covington.

The authors would like to thank Emma Boland, Liz Owen, Will Shuckburgh, Georgie Weedon, Stuart Capstick, Charles Simmonds, Robert Doubleday, Stephen Smith, Faith Culshaw, Peter Hurrell, Jo Lovell, Sandra Cotterill, David Spiegelhalter, Wouter Poortinga, Alexa Spence, Lorraine Whitmarsh, Christina Demski, James Painter, Bob Ward, Alan Rodger and Rowan Sutton for comments and advice, and would like to acknowledge the valuable assistance of Josephine Hansom, Polly Hollings and Darren Yaxley from GfK-NOP and the staff at the Cambridge Programme for Sustainability Leadership. The authors would also like to thank all the individuals who took part in the focus groups.



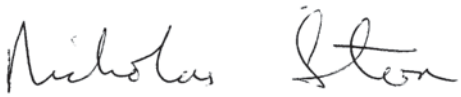
This paper may be cited as Shuckburgh, E., Robison, R. and Pidgeon, N. (2012). *Climate Science, the Public and the News Media.* Living With Environmental Change.



**General contact details:**
**Emily Shuckburgh, British Antarctic Survey, High Cross, Madingley Road, Cambridge, UK**
**Email: emily.shuckburgh@bas.ac.uk**

# Foreword

This important new report addresses the critical issue of how climate scientists can improve their communication with the public, particularly through the media. The quantity and quality of coverage of climate change has undoubtedly declined across most of the UK media over the past few years, and climate scientists must renew their efforts to communicate with skill and clarity if the public is to understand what is at stake. If climate scientists do not respond to this challenge, public debate will instead be framed around the arguments of vested commercial and political interests. The public needs climate scientists to explain the results of their research, including the uncertainties, and to play a full part in the debate about how best to manage the risks of climate change. It is absolutely essential for sound policy-making and decision-making, as well as to democratic debate, that climate scientists spell out very clearly the nature and scale of the risks we face from unmanaged climate change. The consequences are obviously uncertain and climate scientists may have difficulty in expressing the potential outcomes in terms which journalists and the public can fully comprehend. But it is crucial for them to convey the dangers of assuming that the risks from unmanaged climate change are negligible. This report should help climate scientists to fulfil this vital role in the public debate.



**Professor Lord Stern of Brentford**

Chair
Grantham Research Institute on Climate Change and the Environment
London School of Economics and Political Science

# Contents

# Executive Summary

This report examines public attitudes to climate science and its representation in the news media. It details the results of a survey of the UK population conducted in March 2011, which was complemented by a series of focus groups conducted in London, Sutton Coldfield and Newcastle-upon-Tyne at the same time, and presents the findings in the context of a review of the relevant existing literature.

Recent reports (Muir Russell 2010; Inter Academy Council 2010) have emphasised the need to communicate the scientific evidence concerning climate change in a way the general public can more readily understand and engage with. However, the best way to achieve this is not self-evident.

The purpose of this report is to investigate how effectively the main conclusions of climate science are being communicated to the general public in the UK and how communication of climate science through the news media might better engage the public. It represents a first step towards adopting a more rigorous approach to climate science communication that incorporates testing and evaluation of what works and what does not work in terms of public engagement.

A reasonable and realistic goal of climate science communication might be to provide information that is necessary, if not sufficient in itself, for the public to make informed choices about policies or actions. The findings of this report suggest that current approaches to communicating climate science have not produced a clear understanding of the current state of knowledge and they provide backing for an alternative approach that is less didactic and more engaged with the public. The report makes suggestions for improvements to this end.

## Key Messages

1) **The study shows that while a substantial majority of the UK public believe the world's climate is changing, many feel relatively uninformed about, or uninterested in, the findings of climate science, and a sizable minority do not trust climate scientists to tell the truth about climate change:**

   - Less than half the UK public say they know a 'fair' amount or more about climate change, and less than half like to read and think about it. Climate change is often conflated with other environmental issues and many people fail to identify unprompted the relevance of certain activities which contribute towards climate change such as everyday gas and electricity use.
   - This apparent lack of knowledge or interest in climate science is tinged with a marked note of scepticism. While the majority of the UK public believe that the world's climate is changing, their levels of concern have decreased over the past five years (as has their willingness to change behaviour to limit climate change) and the proportion who believe the seriousness of climate change has been exaggerated has increased to include almost half the population. Trust in 'authority groups' (e.g. scientists, government, business and industry, environmental groups and the media) to give an accurate portrayal of climate change has decreased in recent years. Moreover, one-third of the UK public do not trust climate scientists to tell the truth about climate change.
   - Attitudes to climate change are correlated with the level of engagement the public has with climate change as a topic (in particular how much they like to read and think about it, but also self-assessed knowledge) and with their confidence in climate science (i.e. whether they think most scientists agree on the human causes of climate change, whether they trust climate scientists to tell the truth about climate change and whether they think the seriousness of climate change has been exaggerated). However, the cause/effect cannot be determined from our survey data and it is important to recognise that an individual's political beliefs, personal values and worldview are likely to contribute to their attitudes to climate change.

These findings may in part reflect psychological aspects of opinion formation, such as a focus on other concerns perceived to be more pressing or a lack of personal experience of climate change, as well as adverse reactions to climate stories in the media perceived as 'alarmist'. Nevertheless, they indicate that the conclusions

of mainstream climate science are not being communicated very effectively and they highlight the importance of focusing effort on communicating the science in open, transparent ways that embrace two-way dialogue and engagement.

2) **Effective communication of climate science needs new ways of engaging with the public. Key findings from the focus groups and a review of the relevant literature on how communication of climate science through the news media might be improved are:**

   - Cultural factors influence the way the public assimilate and process information and these should be taken into account when designing a communications approach. Opportunities to do this include: encouraging a range of talented science communicators from different backgrounds; giving thought to how climate scientists might work with others to embed scientific statements in broader messages using diverse communications channels; and encouraging activities that encompass two-way engagement between scientists and the public.
   - Communications could be designed to accommodate the different interests and scientific literacy of the audience and tested to ensure the information is presented in a manner that most aids understanding. Providing a clear and meaningful illustration of the key information and concepts might help build some intuition for unfamiliar topics. This could be a simple graphical description, a straightforward explanation of a mechanism, or an 'indicator of change' such as the decline in the number of bees. It may also be helpful to expose more scientists to the complexities of opinion formation by the public (e.g. through involvement in public engagement activities), allowing greater mutual understanding and a more deliberative model of communication.
   - Other key factors that may help engage the audience include: personal relevance (e.g. a connection to the local area); novelty (e.g. a new angle to a piece of science information); clarity of language and style; the delivery of scientific evidence in a non-alarmist, non-manipulative but passionate manner; and the inclusion of information on how people might use the scientific results being presented (which may require scientists to work in collaboration with others to communicate a message and its implications).
   - Careful attention should be paid to communicating around topics known to be susceptible to misinterpretation. A particular example is 'uncertainty', where scientific and public interpretations of the term can diverge. Scientists need to be aware that, by their choice of wording, they may unwittingly alter the way a statement is interpreted. Great care should be taken in constructing statements of scientific uncertainty and their framing, and messages should be tested to ensure they are not misconstrued. Re-phrasing such statements using the everyday public language of risk might help alleviate the problem.

The results of the focus groups have highlighted the value of involving the public in shaping communications strategies. This provides evidence supporting a broader approach to public engagement with science.

* * * * *

It is anticipated that the findings presented in this report may be useful to anyone involved in climate science communication, including climate scientists, institutional press officers and journalists. They may also be of wider relevance to the communication of other scientific issues.

# Introduction

In this report, we examine the attitudes of the UK public to climate science and its representation in the news media. The report's three main goals are to:

(i) document and evaluate public opinion about climate change and examine recent trends;

(ii) investigate how effectively the main conclusions of climate science are being communicated to the general public in the UK; and

(iii) explore how communication of climate science through the news media might better engage the public.

Climate change is one of the foremost global challenges of our time. The scientific consensus as reported by the Intergovernmental Panel on Climate Change (IPCC) is that, without action to reduce emissions of greenhouse gases, there is a significant probability that global average temperatures will increase to be more than 2°C higher than in pre-industrial times, with substantial changes in regional climate and damaging consequences for human welfare and ecological systems, over the course of this century and beyond (IPCC 2007).

The UK Climate Change Act 2008 sets legally binding targets for UK greenhouse gas emissions reductions. The climate objective underpinning the Act involves limiting future temperature rise to levels deemed an acceptable risk. The targets are based on recommendations by the UK Committee on Climate Change, which is required to consider developments in scientific knowledge about climate change (Committee on Climate Change 2008; Committee on Climate Change 2010). The Act also makes provision for the UK to adapt to climate changes that cannot now be avoided. With this background, there is a strong imperative to ensure that evidence from climate science is communicated effectively to the UK public to allow them to make informed decisions of relevance to their future.

Communicating climate science is challenging because of the range and complexity of the topic and the uncertainties surrounding potential future climate change (Pidgeon and Fischhoff 2011). Human behaviour is such that the process of learning is multi-dimensional and closely linked to the cultural context in which it occurs (Weber 2010). There is compelling evidence that, for most, attitudes to climate change are more closely shaped by existing values and worldviews than by level of knowledge of the scientific evidence base (Hulme 2009; Whitmarsh 2011). This means that the effective communication of scientific information to the public is a non-trivial exercise and the impact that information may or may not have on public opinion formation is subtle. A number of recent reports have emphasised the need for an improved communications strategy to explain scientific research results in ways that the public can access and understand (InterAcademy Council 2010; Russell 2010).

The best way to achieve this needs careful consideration. In recent years, there has been strong criticism from those working in the social sciences of the model that suggests the public is deficient in scientific knowledge and that this should be addressed in a straightforward way by education from experts (Nerlich et al. 2010). For a long time, climate change has been viewed as a serious problem by much of the public, both in the UK and throughout many nations of the world (Brechin and Bhandari 2011). However, opinion polls indicate that the public in the UK and elsewhere are becoming more uncertain about the issue (Poortinga et al. 2011). One of the primary routes by which the public acquires climate science information is through the news media, but the relationship between media information and public engagement in climate change issues is not straightforward (Boykoff and Smith 2010).

Together this has provided the impetus to assess in detail public attitudes to climate science and its representation in the news media and to investigate how the communication of scientific results through the media may be improved. To this end, this report presents the results of a project encompassing a survey of UK national opinion and public focus groups. Since the cultural context in which science communication occurs determines the way in which information is assimilated by the public, the report attempts to map aspects of this broader context.

GfK-NOP carried out the fieldwork and, on completion, provided the authors of this report with (i) the survey data in data tables and .sav files for use in the statistical software package SPSS and (ii) the transcripts of the focus groups. The authors were responsible for the design of the questionnaire and the discussion guide for the focus groups, as well as the analysis, interpretation and reporting of the results. The analysis presented here was partly informed by analysis undertaken by GfK-NOP and has taken into account previous work in this area.

# The Research Methodology

## Quantitative Research

A module of ten questions was placed on GfK-NOP's Random Location Omnibus (RLO). The RLO is a nationally representative face-to-face survey of 2000 people across the UK (England, Scotland, Wales and Northern Ireland) that takes place each week. The main fieldwork was conducted from 17th to 22nd March 2011, with one question repeated from 12th to 17th May 2011[1]. Half of the RLO sample (1007 respondents) were chosen to be asked our survey module. Table 1 shows a detailed breakdown of our survey module sample.

**Table 1: Characteristics of the 2011 survey sample (N = 1007).**

| | | Unweighted | | Weighted | |
|---|---|---|---|---|---|
| **Characteristic** | | **N** | **%** | **N** | **%** |
| **Gender** | Male | 480 | 48 | 493 | 49 |
| | Female | 527 | 52 | 514 | 51 |
| **Age** | 16-24 | 113 | 11 | 150 | 15 |
| | 25-34 | 174 | 17 | 161 | 16 |
| | 35-44 | 184 | 18 | 180 | 18 |
| | 45-54 | 190 | 19 | 167 | 17 |
| | 55-64 | 132 | 13 | 146 | 14 |
| | 65+ | 214 | 21 | 202 | 20 |
| **Working status** | Full-time | 418 | 42 | 433 | 43 |
| | Part-time | 138 | 14 | 150 | 15 |
| | Not working | 451 | 45 | 423 | 42 |

Each respondent was assigned a 'weight' so that the sample was representative of the UK population. Additional information was collected to enable sub-sampling of the survey, including socio-economic group[2] (SEG), region of the UK[3], presence of children in the household and education level[4].

In all cases, the questions asked had been asked in previous opinion polls (see Appendix for details of the questions and previous polls). This ensured that the questions had been appropriately piloted. However, when interpreting any trends in the results over time, it should be noted that the context in which the questions were asked (e.g. the accompanying questions) and the method of delivery of surveys were often different.

## Qualitative Research

Six focus groups were held with the general public in March 2011. Each focus group of eight participants[5] was moderated by a member of the GfK-NOP Social Research Team and lasted two hours.

Table 2 highlights the focus group sample structure. The sample was selected from three different locations (urban, semi-urban and semi-rural) across England and included individuals from a range of backgrounds and with various attitudes to climate change. Two focus groups were conducted in each location; London was selected as the urban location, Sutton Coldfield was the semi-rural location and a suburban Newcastle-upon-Tyne location was also selected.

Each focus group contained individuals from a similar SEG, with similar household income and with similar educational qualifications, in order to create reasonably homogeneous groups and facilitate lively discussion. We also ensured that each focus group contained participants who shared similar attitudes towards climate change. This enabled the moderator to facilitate discussions focused on the research objectives rather than having to

[1] *The question was repeated with 1013 respondents to gather more information concerning what people think the consequences of climate change are. The responses for the repeat fell broadly within the confidence intervals of the initial survey; see Appendix Q9 for details.*
[2] *A classification system (A, B, C1, C2, D, E) used in the UK by market researchers to determine socio-economic grade of respondents; see http://www.mrs.org.uk/publications/downloads/occgroups6.pdf*
[3] *Defined as: Scotland, North East, North West, Yorkshire & Humber, Ulster, East Midlands, West Midlands, Wales, Eastern, London, South East and South West.*
[4] *Education level classified as follows: No qualifications = 'low'; O-Level, A-Level, HNC, GNVQ, NVQ/SVQ level 1-3, GCSE, CSE, City & Guilds = 'medium'; Degree, Postgraduate, NVQ/SVQ level 4, HND, HNVQ = 'high'.*
[5] *One group had seven participants.*

manage differences of opinion about wider climate change issues. We divided the participants in this respect according to the following criteria[6]:

- *Natural causes*: participants who thought that climate change is caused entirely/mainly by natural causes and participants who did not believe that climate change exists.
- *Mixed causes*: participants who thought that climate change is partly caused by natural processes and partly caused by human activity.
- *Human causes*: participants who thought that climate change is caused entirely/mainly by human activity.

Overall, a mix of participants of different backgrounds and attitudes ensured that a range of opinions was captured. The different composition of each group provided some insight as to how such differences may influence attitudes to climate science. As the research neither covered gender-specific questions nor addressed sensitive or personal topics, the sample was split evenly between males and females mixed together in the same focus group. In the remainder of the document, we refer to each group by their location and climate change attitude, e.g. London, human causes.

**Table 2: Focus group sample structure.**

| 6 focus groups | | | | | | |
|---|---|---|---|---|---|---|
| **Focus group** | **Location** | **Climate change attitude** | **Age/lifestage** | **SEG/ household income** | **Gender** | **Education** |
| 1 | London | Human causes | Under 45 years. Mix of children at/not at home | BC1C2D £25K+ | Even split | Medium-High (A-Level or degree+) |
| 2 | | Mixed causes | 25-44 years. Mix of children at/not at home | BC1C2D £17.5K+ | Even split | Spread of education levels |
| 3 | Newcastle-upon-Tyne | Human causes | 45+ years. No children at home/post family | C1C2DE <£17.5K | Even split | Low-Medium (GCSE/no formal qualifications) |
| 4 | | Natural causes | 45+ years. No children at home/post family | C1C2DE <£17.5K | Even split | Low-Medium (GCSE/no formal qualifications) |
| 5 | Sutton Coldfield | Mixed causes | 45-65 years. Mix of children at/not at home | BC1C2D £17.5K+ | Even split | Spread of education levels |
| 6 | | Natural causes | Under 45 years. Mix of children at/not at home | BC1C2D £25+ | Even split | Medium-High (A-Level or degree+) |

Each focus group began with a general discussion to assess the participants' interest in science generally and in climate science in particular. This introduced the topic and explored where members of the public currently come across climate science. The participants were then asked to review a number of UK television, radio and newspaper articles related to climate science which had been published during the previous 12 months. Twenty-six newspaper articles were available for discussion, drawn from across UK national papers and chosen to give a range of viewpoints on climate science[7] (see Table 3).

The participants were asked to pick one article to read and discuss. In addition, two television news items were taken from BBC News[8], with a radio news item from BBC Radio 4[9] being used in place of one of these in the first focus group (London, human causes). The number of times an article/item was chosen by a focus group is indicated in the Table. The participants evaluated the news items according to:

- their level of interest in the topic;
- how easy it was to understand; and
- how the news item could be improved.

[6] *Potential participants were asked our survey question Q3 (see Appendix) at a screening stage to determine this categorisation.*
[7] *The articles were chosen by searching UK national newspapers over the 12 month period from March 2010 to February 2011 for articles containing the terms 'climate change' or 'global warming'. A selection of articles was chosen to cover a range of topics, styles and opinions, with a balance of articles from tabloid and broadsheet newspapers. The scientific accuracy of the articles was not taken into account. Since the sample was specifically chosen to include a range of articles with 'supporting', 'mixed' and 'dissenting' headlines it should not be taken to be representative of a random sample.*
[8] *'Climate change raises flood risk, researchers say', BBC News, 16th February 2011, http://www.bbc.co.uk/news/science-environment-12487913 and 'UN climate deal hopes in Mexico look bleak', BBC News, 10th December 2010, http://www.bbc.co.uk/news/science-environment-11974284*
[9] *'Global temperature "still warming"', BBC Radio 4, Today Programme, 26th November 2010, http://news.bbc.co.uk/today/hi/today/newsid_9231000/9231192.stm*

Once the groups had reviewed the news items, participants were asked to discuss how they would prefer to receive information about climate science and from which sources.

In addition to the six focus groups with the public, two focus groups were held with university academics, also in March 2011. One focus group was held with arts/humanities academics and a second with science academics (excluding those involved directly in climate science research). Academics were drawn from a 'convenience sample' of individuals working at the University of Cambridge. These additional focus groups lasted one hour and concentrated on the evaluation of media material and overall opinions about climate science. The aim of conducting the academic focus groups was to give an indication of differences and similarities with the general public, although a more extensive study would be required to draw firm conclusions about this particular issue.

**Table 3: Newspaper articles used in the focus groups, with classification based on headline alone[10].**

| Date | Source | Headline | Classification | Chosen |
|---|---|---|---|---|
| 5/3/2010 | Daily Express | Climate scientists hit back at sceptics with new global warming evidence | Supporting | 3 |
| 5/3/2010 | Daily Mirror | New global warming study points finger at human activity | Supporting | |
| 4/4/2010 | Sunday Times | Arctic recovers from the great melt | Dissenting | 3 |
| *1/6/2010* | *Times* | *Night-time temperatures could rise above 25C because of climate change* | *Supporting* | *1* |
| 25/7/2010 | Independent | Climate change makes marmots munch and mate: study | Supporting | |
| *11/8/2010* | *Sun* | *Outlook: chaos* | *Supporting* | *3* |
| *6/9/2010* | *Daily Mirror* | *Bee loss caused by climate change may hit plants* | *Supporting* | *5* |
| 7/10/2010 | Daily Express | Solar probe warms hopes of climate change sceptics | Dissenting | 1 |
| 26/11/2010 | BBC website | Met Office say 2010 "among hottest on record" | Supporting | |
| 26/11/2010 | Daily Mail | Global warming has slowed down over past 10 years, say scientists | Mixed | 4 |
| 26/11/2010 | Financial Times | World is growing warmer, but pace slows | Mixed | |
| 26/11/2010 | Guardian | World is warming quicker than thought in past decade, says Met Office | Supporting | 1 |
| 26/11/2010 | Daily Telegraph | Global warming has slowed because of pollution | Mixed | 1 |
| 7/12/2010 | Sun | Yes we bungled but we've still got a big problem on our hands say UK scientists | Mixed | 1 |
| *17/12/2010* | *Daily Mirror* | *Is the record cold snap caused by global warming?* | *Mixed* | *1* |
| *19/12/2010* | *Sunday Telegraph* | *The man who repeatedly beats the Met Office at its own game* | *Dissenting* | *1* |
| 21/12/2010 | Daily Express | Dawn of a new ice age | Dissenting | 2 |
| *21/12/2010* | *Independent* | *UK may be cold, but it's still a warm year says Met Office Chief* | *Mixed* | *1* |
| *24/12/2010* | *Independent* | *Expect more extreme winters thanks to global warming, scientists say* | *Supporting* | *1* |
| *25/12/2010* | *Daily Mail* | *Global warming "will give Britain longer, colder winters" as melting sea ice plays havoc with weather patterns* | *Supporting* | *3* |
| 26/1/2011 | Guardian | Greenland ice sheet is safer than scientists previously thought | Mixed | 2 |
| *16/2/2011* | *BBC website* | *Climate change raises flood risk, researchers say* | *Supporting* | *1* |
| *17/2/2011* | *Daily Mail* | *Devastating floods are now twice as likely thanks to climate change, scientists claim* | *Supporting* | *3* |
| *17/2/2011* | *Guardian* | *Climate change doubled likelihood of devastating UK floods of 2000* | *Supporting* | *1* |
| *17/2/2011* | *Sun* | *Flooded by man* | *Supporting* | *2* |
| *17/2/2011* | *Daily Telegraph* | *Floods caused by climate change* | *Supporting* | *3* |

*Articles in italics are more focused on UK future climate projections, UK extreme weather or UK wildlife; the rest are more focused on global climate change. For one group (London, human causes), three of the articles chosen were not recorded.*

[10] *The newspaper articles were classified as 'supporting', 'mixed' or 'dissenting', according to whether their headline supported the arguments for human-induced climate change. Articles whose headline appeared to be dissenting but which mentioned scientists as having reached this conclusion were assigned to the 'mixed' category. These categorisations were not necessarily reflective of the content of the article.*

# The Findings

## Section 1: Public Attitudes to Climate Change and Climate Science

### 1.1 Acceptance of, and concern about, climate change

In the UK and throughout the world, previous studies have indicated that the majority of people accept that climate change is happening, that it is a serious problem and that action is required to limit it (Pidgeon 2010; World Bank 2010). However, in the UK, Europe and the US, surveys have indicated a gradual decrease in concern over the past several years (Poortinga et al. 2011). We therefore included in our survey a series of questions assessing people's current perceptions of the reality of climate change and their level of concern about it.

- **The majority of respondents to our survey (80±2%) considered that the world's climate is changing, while 13% did not[11].** In the period January-March 2010[12], marginally fewer respondents considered this to be true (78% did; 15% did not). This may be a sign of a plateau following the drop in confidence observed in repeat surveys containing similarly worded questions that were conducted before/after a number of climate science controversies which received significant media attention in late 2009 and early 2010[13]. Nevertheless, this is a significant drop compared with 2005[14] when 91% considered the climate to be changing and only 4% did not.
- **Regional differences within the UK in the percentage who consider the world's climate to be changing are small and not statistically significant given the sample size[15]**. In our survey, a larger percentage of those with high levels of educational attainment (88±4%) than low attainment (76±6%) considered the world's climate to be changing.
- **We found people most commonly believe that climate change is caused by a combination of human activity and natural processes (46±3%)**. 28% consider it to be caused mainly or entirely by human activity and 20% mainly or entirely by natural processes[16]. All these percentages are largely unchanged from 2010[17]. However, there has been a significant increase in the percentage who attribute climate change to natural causes since the Met Office/Environment Agency (EA) asked a similar question in 2009, when only 9% were of this opinion[18].
- **There is little difference between the groups who say that climate change is 'entirely', 'mainly' or 'partly' caused by human activities in their level of concern and willingness to change their behaviour**. In contrast, the groups who say climate change is 'entirely' or 'mainly' due to natural causes differ in these two respects. This is illustrated in Table 4a.

**Table 4a: Comparison between subgroups with different opinions about the causes of climate change (Q3). For each subgroup, the percentages who agree with three climate change statements (Q2, Q1 and Q10b) are presented.**

| Cause of climate change (Q3) | Agree that climate change is happening (Q2) | Are concerned about climate change (Q1) | Are willing to change their behaviour (Q10b) |
|---|---|---|---|
| Entirely or mainly natural | 66±7%* | 38±7%* | 50±7%* |
| Partly natural/partly human | 85±3%* | 72±4% | 79±4% |
| Entirely or mainly human | 93±3%* | 75±5% | 75±5% |

*Source: results from Q2, Q1 and Q10b segmented according to Q3. 'Agree that climate change is happening' = those who responded 'yes' to Q2; 'Are concerned about climate change' and 'Are willing to change their behaviour' = those who 'strongly agree' or 'tend to agree' with Q1 and Q10b. The 95% confidence intervals are also given and * denotes significantly different results, i.e. where the 95% confidence intervals do not overlap.*

[11] *Appendix: Q2.*
[12] *In an opinion poll, hereafter 'Cardiff/Ipsos MORI (2010)', of 1822 British adults aged 15+ carried out by Ipsos MORI for Cardiff University between 6th January and 26th March 2010 (Spence et al. 2010).*
[13] *The BBC reported a fall from 83% to 75%, between November 2009 and February 2010, in the number of people agreeing with the question: 'From what you have heard, do you think that the Earth's climate is changing and global warming taking place?' (Times/Populus 2009; BBC/Populus 2010). The Department for Transport (DfT) found a drop in the percentage who said they were at least fairly concerned that climate change is happening, also from 83% to 75%, between August 2009 and August 2010 (Department for Transport 2011).*
[14] *In an opinion poll, hereafter 'UEA/MORI (2005)', of 1491 British adults aged 15+ carried out by MORI for the University of East Anglia (UEA) between 1st October and 6th November 2005 (Poortinga et al. 2006).*
[15] *Scotland (83%), North East (91%), North West (84%), Yorkshire & Humber (73%), Ulster (83%), East Midlands (72%), West Midlands (82%), Wales (90%), Eastern (80%), London (73%), South East (81%), South West (81%).*
[16] *Appendix: Q3.*
[17] *See Cardiff/Ipsos MORI (2010).*
[18] *In an opinion poll, hereafter 'Met Office/EA/Ipsos MORI (2009)', of 998 UK adults aged 16+ carried out by Ipsos MORI for the Met Office and the EA in August 2009, when asked the question 'Thinking about the causes of climate change, which of the following best describes your opinion?', 9% said 'mainly natural processes', 45% said 'partly natural/partly human processes' and 34% said 'mainly human processes'.*
[19] *This analysis excluded those who stated 'I think there is no such thing as climate change', 'don't know' or 'no opinion' in response to Q3 (total 6% of respondents).*

- **Just under two-thirds (63±3%) of respondents were at least fairly concerned about climate change**[20]. However, in early 2010 this was a higher percentage (71%) and 82% expressed concern in answer to a very similar question asked in 2005[21]. The percentage of respondents who are not at all concerned has increased from 3% in 2005, through 8% in 2010, to 13% in 2011. Previous studies have shown that concern about environmental risks fluctuate over time as worry about other risks to which people are exposed varies, as if people only have so much capacity for worry or a 'finite pool of worry' (Weber 2010).
- **Consistent with findings from DfT public attitude surveys**[22]: (a) a smaller percentage of young people aged 16 to 24 expressed concern (52%) than older people (70% of those aged 35 to 64); (b) a larger percentage of those with high educational attainment were concerned (74%) than the overall average (63%); and (c) men were less concerned (59%) than women (67%).
- **Almost half (44±3%) of the respondents believed that the seriousness of climate change is exaggerated**[23]. This is a slight increase from 2010 (40%) and is considerably higher than the value found across Europe (27%)[24]. The percentage of people who do not believe that the seriousness of climate change is exaggerated has dropped significantly from 42% in 2010 to 35% in 2011. Previous studies have found that the belief that the seriousness is exaggerated has increased in recent years[25].
- **Just over two-thirds (69±3%) of respondents agreed they would be willing to change their behaviour to help limit climate change**[26]. There has been a statistically significant decrease in this percentage from August 2006[27] when it was 77%.
- **One in ten (10%) rejected the notion of anthropogenic climate change**[28]. This is consistent with previous surveys (Whitmarsh 2011). Also as found in previous surveys, men (13%), older people over 65 (17%) and those with low educational attainment (16%) are more likely to reject the notion.

**Conclusions: The majority of the sample in our UK survey accepted that the world's climate is changing. However, over the past five years, levels of concern among the public and expressed willingness to change behaviour in order to limit climate change have both decreased. In addition, almost half of the public believed that the seriousness of climate change has been exaggerated.**

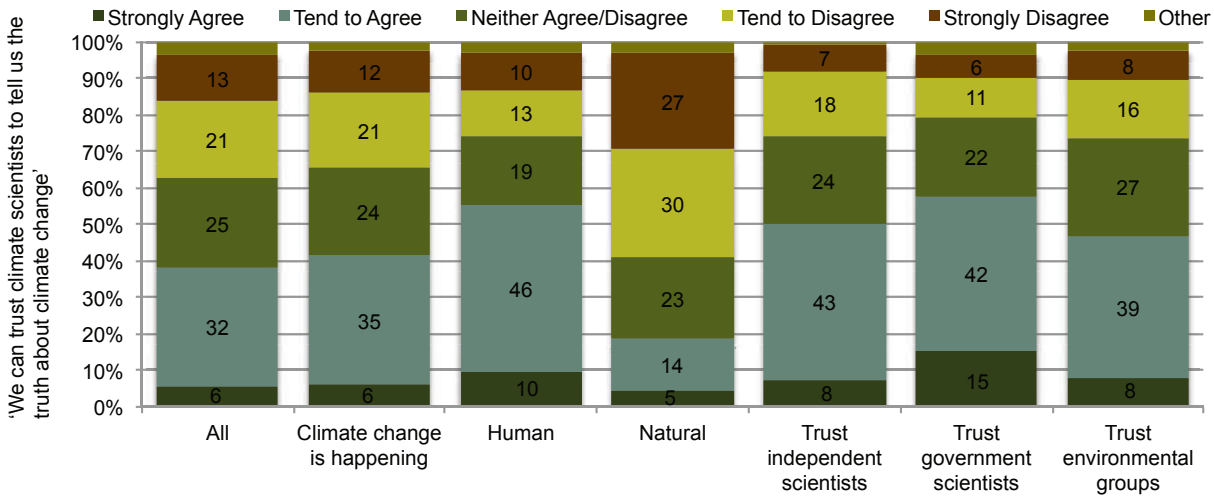
### 1.2 Attitudes to climate science and scientists

Past studies have indicated that the public process climate science information in the context of a broad set of cultural stimuli. Individuals process identical information differently according to their prior knowledge, cognitive abilities, values and worldviews, and due to broader social and institutional factors (Nerlich et al. 2010; Whitmarsh 2011). Indeed, studies show that cultural factors influence the trust that individuals bestow upon experts and thus influence their assessment of scientific consensus (Kahan et al. 2011a). That notwithstanding, we asked a series of survey questions to assess the respondents' attitudes to climate science and scientists, and how this might correlate with their more general attitudes to climate change.

[20] *Appendix: Q1.*
[21] *See Cardiff/Ipsos MORI (2010) and UEA/MORI (2005); 'expressed concern' means the respondent was either 'fairly' or 'very' concerned. A drop in concern over this time period was also noted in repeat surveys for the DfT (DfT public attitudes report, Jan 2011), from 81% in 2006 to 70% in August 2010.*
[22] *A series of opinion polls were conducted for the DfT from 2006 to 2009 (reported in Department for Transport 2010), and further polls were conducted in 2010 (reported in Department for Transport 2011) and in 2011 (reported in Department for Transport 2012). Hereafter these polls will be referred to as 'DfT (2006-2011)' with the year representing the year the poll was undertaken. In 2009, people aged 16 to 24 expressed lower levels of concern (61%) than older people (76% across all ages). In the 2011 DfT survey, 81% of graduates were concerned compared with 61% of non-graduates, and 59% of men were concerned compared with 69% of women.*
[23] *Appendix: Q4a.*
[24] *See Cardiff/Ipsos MORI (2010) and European results reported in Poortinga et al. (2011).*
[25] *Whitmarsh (2011) reported 15% agreement that claims that human activities are changing the climate are exaggerated in 2003 and 29% in 2008; Taylor (2011) reported that the percentage who agreed 'many claims about environmental threats are exaggerated' had increased from 24% in 2000 to 37% in 2010.*
[26] *Appendix: Q10b.*
[27] *See DfT (2011).*
[28] *Participants were categorised as rejecting the notion if they agreed to at least five of the following statements: (i) they are not very or not at all concerned about climate change (Q1), (ii) they do not think the climate is changing (Q2), (iii) they think climate change is caused mainly or entirely by natural processes, or that there is no such thing as climate change (Q3), (iv) they strongly or tend to agree that the seriousness of climate change is exaggerated (Q4a), (v) they strongly or tend to disagree that scientists agree humans are causing climate change (Q4b), (vi) they think natural causes contribute towards climate change (Q8), (vii) they think there are no consequences of climate change (Q9) and (viii) they strongly or tend to disagree that they would be willing to change their behaviour to limit climate change (Q10b).*

- **Just over one-third (38±3%) of respondents agreed that 'climate scientists can be trusted to tell us the truth about climate change'**, while one-third (34%) disagreed and a quarter (25%) neither agreed nor disagreed[29]. These percentages are largely unaltered if they are restricted to those who agree that climate change is happening (see Figure 1). An online survey conducted in November 2010 found that a smaller percentage[30] (24±4%) agreed that climate scientists can be trusted to tell the truth about climate change[31], although methodological differences may account for this difference. In comparison, other surveys have indicated much higher agreement (more than two-thirds) that scientists can be trusted to tell the truth generally[32].

**Figure 1: Level of trust in climate scientists to tell the truth about climate change (Q6) in the entire population and within subgroups who think climate change is happening, who think the causes of climate change are human or natural and who trust various other authority groups to give correct information on climate change.**




*Source: results from Q6, segmented according to Q2 ('Climate change is happening'), Q3 ('Human/natural causes') and Q7 ('Trust in authority groups'). 'Change change is happening'= those who responded 'yes' to Q2; 'Human' includes those who agreed climate change is mainly or entirely due to human causes; 'Natural' includes those who agreed it is mainly or entirely due to natural processes.*

- **More than half (57%) of those who think that the causes of climate change are mainly or entirely natural distrust climate scientists** compared with less than a quarter (23%) of those who think the causes are mainly or entirely human[33]; again see Figure 1.
- **Those who think that the causes of climate change are mainly or entirely natural are more likely to distrust the scientific case (according to several of the survey questions) than those who think it is at least partly due to human activities**. The group who think it is mainly or entirely natural are more likely to think climate change is exaggerated, less likely to think scientists agree that humans are causing climate change and less likely to trust climate scientists to tell them the truth about climate change. This is illustrated in Table 4b.

[29] *Appendix: Q6.*
[30] *A survey conducted using online sampling by Maximiles, sample size 499, for the University of Cardiff. Data collection took place from 23rd to 25th November 2010; see Demski (2011).*
[31] *See also the YouGov/Sunday Times poll from 3rd to 4th December 2009 which asked: 'Turning to another issue, there have been recent controversies surrounding climate change research at the University of East Anglia. In general do you trust climate scientists to tell the truth about global warming or not?' Slightly fewer responded 'yes' (41%) than 'no' (44%). See http://iis.yougov.co.uk/extranets/ygarchives/content/pdf/ST-results_DEC09.pdf*
[32] *Surveys conducted by Ipsos MORI between 1983 and 2011 with samples of 1000 to 2000 British adults aged 15+ (Ipsos MORI 2011). The most recent fieldwork was conducted from 10th to 16th June 2011 with a sample size of 1026. In response to 'Now I will read you a list of different types of people. For each would you tell me if you generally trust them to tell the truth or not', the average response over the period 1983 to 2011 for trust in 'scientists' was 67% (71% in 2011) and for trust in 'professors' was 77% (74% in 2011).*
[33] *Note that this correlation is consistent not only with people's opinions about the causes of climate change being influenced by their trust in climate scientists, but also with the hypothesis that individuals are more likely to trust experts who they perceive as sharing their worldviews (Kahan et al. 2011a).*

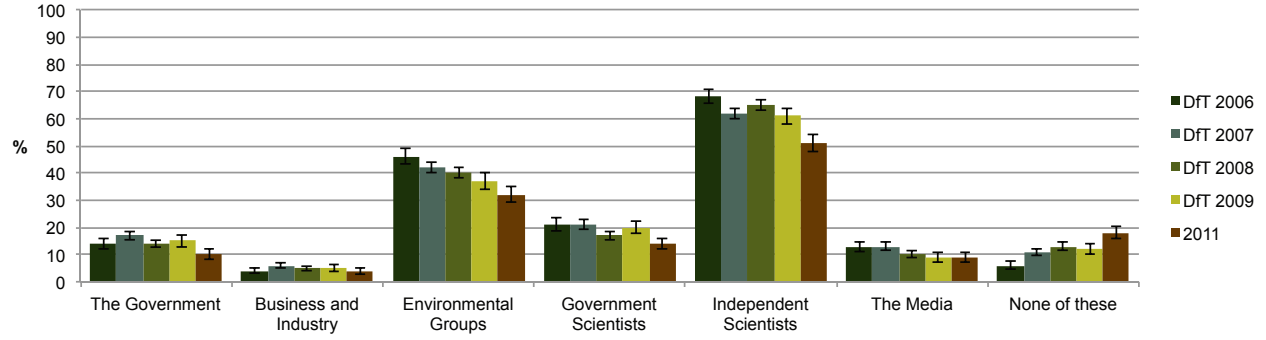
**Table 4b: Comparison between subgroups with different opinions about the causes of climate change (Q3). For each subgroup, the percentages who agree with three climate change statements (Q4a, Q4b and Q6) are presented.**

| Cause of climate change (Q3) | Believe climate change is exaggerated (Q4a) | Agree that most scientists agree humans are causing climate change (Q4b) | Agree climate scientists can be trusted to tell the truth about climate change (Q6) |
|---|---|---|---|
| Entirely or mainly natural | 74±6%* | 43±7%* | 19±5%* |
| Partly natural/partly human | 41±4%* | 58±5%* | 38±4%* |
| Entirely or mainly human | 27±5%* | 85±4%* | 55±6%* |

*Source: results from Q4a, Q4b and Q6 segemented according to Q3. 'Believe climate change is exaggerated', 'Agree that most scientists agree humans are causing climate change' and 'Agree climate scientists can be trusted to tell the truth' = those who 'strongly agree' or 'tend to agree' to Q4a, Q4b and Q6. The 95% confidence intervals are also given and * denotes significantly different results, i.e. where the 95% confidence intervals do not overlap.*

- **Broadly, younger people have more trust in climate scientists than older people have** and the same is true for trust in the government and government scientists[35] (although not for trust in independent scientists or environmental groups). Education level makes a slight difference to the level of trust, with the more highly educated slightly more trusting of climate scientists (43% in the highly educated group trust climate scientists compared with 38% overall).
- **Just over half (51±3%) of the respondents said they trusted 'independent scientists (e.g. university research centres)' to give correct information about climate change**[36]. Indeed, this was the most trusted of the 'authority groups' listed, as found in previous DfT surveys. See Figure 2.
- **One quarter (24%) of those who trust independent scientists to provide correct information on climate change[37] distrust climate scientists to tell the truth about climate change**. 17% of those who trust government scientists and 24% of those who trust environmental groups distrust climate scientists.
- **The percentage who trust independent scientists has fallen significantly in recent years (68% in 2006 compared with 51% in 2011)[38]**. Trust in other authority groups has also fallen (see Figure 2) and there has been a significant increase in the percentage who say that they trust none of the groups to give correct information on climate change (18% in 2011 compared with 6% in 2006). There are many factors that may have influenced this, including the climate science controversies of winter 2009/10 and external factors influencing public trust in UK institutions more generally. In the focus groups, people often expressed concern that scientists or other communicators may have vested interests, in particular with regards to sources of research funding.

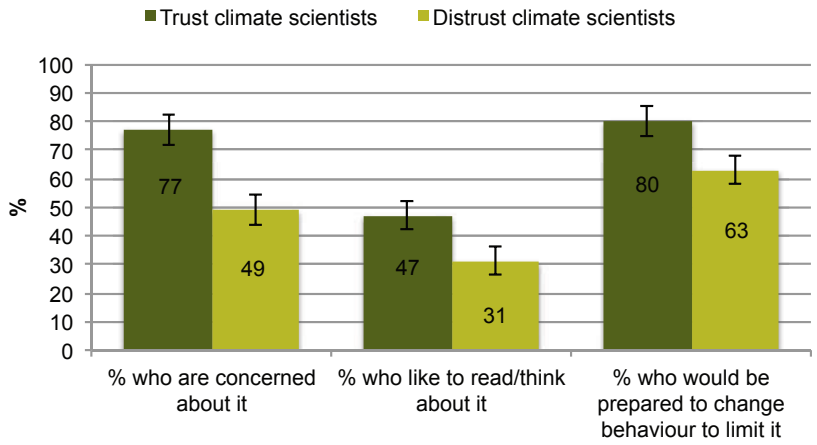
**Figure 2: Percentage who trust various authority groups to give correct information on climate change (Q7).**




*Source: results for Q7 and DfT public attitudes surveys 2006 to 2009; respondents were asked to list all groups they would trust.*

[34] *44% of 16 to 24 year olds agree they can trust climate scientists to tell the truth about climate change, compared with 32% of those aged 65+.*
[35] *16% of 16 to 24 year olds trust government compared with 6% of 65+ year olds; 24% of 16 to 24 year olds trust government scientists compared with 11% of 65+ year olds.*
[36] *Appendix: Q7.*
[37] *Note that the level of trust in climate scientists (as measured by Q6) cannot be compared directly with the level of trust in independent scientists (as measured by Q7) because the questions were phrased differently.*
[38] *See DfT (2010).*

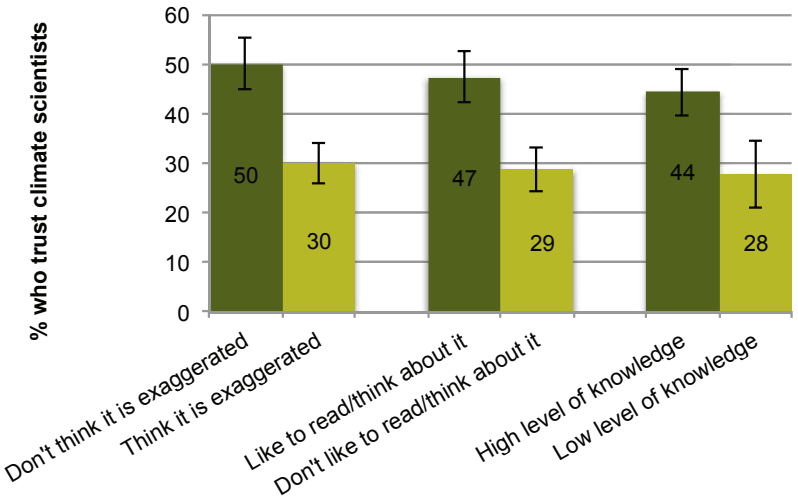
**Figure 3: Comparison between subgroups who trust/distrust climate scientists (Q6). For each subgroup, percentages who are concerned about climate change (Q1), who like to read and think about it (Q10a) and who would be prepared to change their behaviour to limit it (Q10b) are presented.**




*Source: results for Q1, Q10a and Q10b, segmented by Q6. The Q6 results have been grouped as follows: 'Trust climate scientists' = 'strongly agree' or 'tend to agree' and 'Distrust climate scientists' = 'strongly disagree' or 'tend to disagree'. For Q1, Q10a and Q10b, 'are concerned about it', 'like to read/think about it' and 'would be prepared to change behaviour' combine 'strongly agree' and 'tend to agree'.*

- **There is a correlation between interest in and certainty about climate change and trust in climate scientists**. There is more trust in climate scientists among those who disagree that the seriousness of climate change is exaggerated (50% trust compared with 38% overall), among those who like to read and think about climate change (47% trust) and among those who say they know a fair amount or a lot about it (44% trust); see Figure 4.

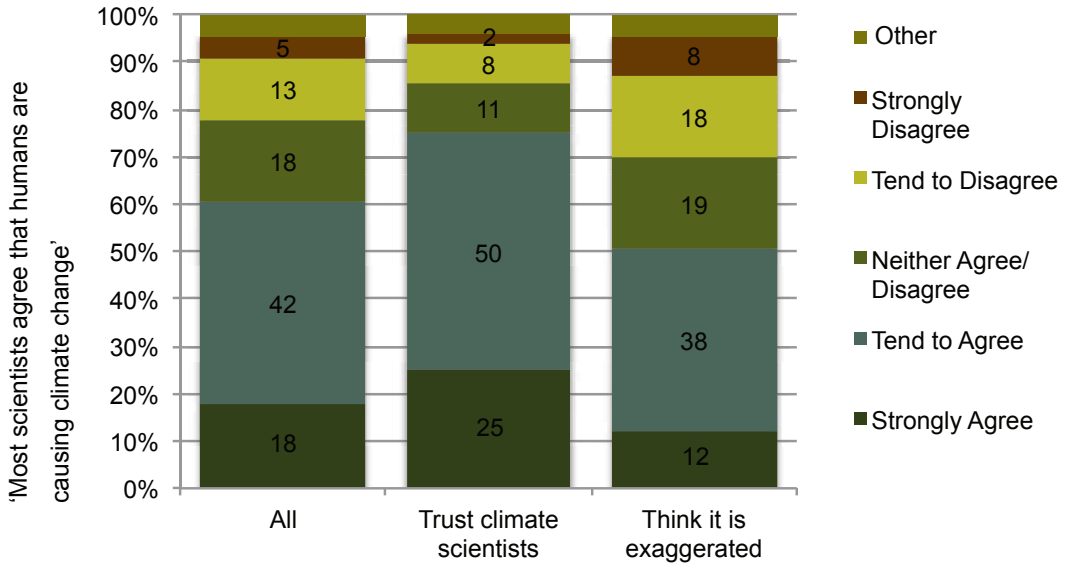
**Figure 4: Percentage who agree that climate scientists can be trusted (Q6) within subgroups determined by attitude to whether the seriousness of climate change has been exaggerated (Q4a), interest in climate change (Q10a) and knowledge about it (Q5).**




*Source: results for Q6, segmented by Q4a, Q10a and Q5. Results have been combined as follows: for Q4a and Q10a, 'think it is exaggerated' and 'like to read and think about it' combine 'strongly agree' and 'tend to agree', and 'don't think it is exaggerated' and 'don't like to read/think about it' combine 'strongly disagree' and 'tend to disagree'. For Q5, 'high level of knowledge' combines the 'a lot' and 'a fair amount' sub-categories and 'low level of knowledge' combines the 'hardly anything' and 'nothing' sub-categories. For Q6, 'trust climate scientists' combines 'strongly agree' and 'tend to agree'.*

- **Under two-thirds (60±3%) of respondents agreed[39] with the statement 'most scientists agree that humans are causing climate change'**. This is a small increase since 2010 (56%[40]), but is low considering several recent studies have reaffirmed that there is broad agreement in the scientific community that human activity is a significant contributing factor in changing global temperatures[41]. There was higher agreement among those who trust climate scientists and among those who do not think the seriousness of climate change is exaggerated (75% in each case) and lower agreement among those who distrust climate scientists and among those who think the seriousness of climate change is exaggerated (50% in each case). See Figure 5.

**Figure 5: Levels of acceptance of a scientific consensus on the causes of climate change (Q4b) in the entire population and within subgroups who trust climate scientists (Q6) and who think the seriousness of climate change is exaggerated (Q4a).**

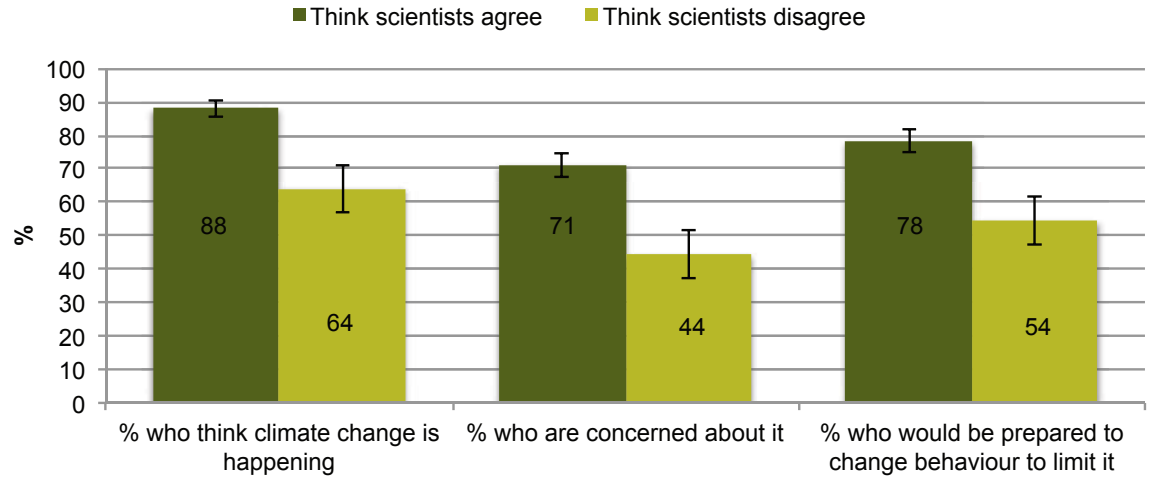



*Source: results for Q4b, segmented by Q6 ('Trust climate scientists') and Q4a ('Think it is exaggerated'). 'Trust climate scientists' = those who 'strongly agree' or 'tend to agree' with Q6, 'Think it is exaggerated' = those who 'strongly agree' or 'tend to agree' with Q4a.*

- **A higher percentage than average of those who believe there is scientific agreement on the human causes of climate change think that climate change is happening (88%), are concerned about it (71%) and would be willing to change their behaviour to limit it (78%)**. See Figure 6.

[39] *Appendix: Q4b.*
[40] *Cardiff/Ipsos MORI (2010).*
[41] *See Doron and Kendall Zimmerman (2009), Anderegg et al. (2010) and Farnsworth and Lichter (2011).*

**Figure 6: Comparison between subgroups who think scientists agree/disagree that humans are causing climate change (Q4b). For each subgroup, percentages who think climate change is happening (Q2), who are concerned about it (Q1) and who would be prepared to change their behaviour to limit it (Q10b) are presented.**




*Source: results for Q2, Q1 and Q10b, segemented by Q4b. The Q4b results have been grouped as follows: 'Think scientists agree' = 'strongly agree' or 'tend to agree' and 'Think scientists disagree' = 'strongly disagree' or 'tend to disagree'. For Q2, Q1 and Q10b, 'think climate change is happening', 'are concerned about it' and 'would be prepared to change behaviour' combine 'strongly agree' and 'tend to agree'.*

- **Measures of public interest, engagement and trust associated with climate science are positively correlated, while the belief that climate change is exaggerated is negatively correlated, with concern about climate change and willingness to change behaviour**, but cause/effect cannot be determined from our survey data[42]. See Table 5a,b.

**Table 5a: Multiple regression (using stepwise method) between results of survey question 'How concerned are you about climate change, sometimes known as global warming?' (Q1) and five survey questions related to attitudes to climate science (Q4a, Q4b, Q5, Q6 and Q10a).**

| Concerned about climate change (Q1) | adjusted $r^2$=0.30 $F_{(5,893)}$=47, p<0.001 | |
|---|---|---|
| **Predictor variable** | **Beta** | **p** |
| The seriousness of climate change is exaggerated (Q4a) | -0.29 | <0.001 |
| Like to read and think about climate change (Q10a) | 0.21 | <0.001 |
| Trust climate scientists to tell the truth about climate change (Q6) | 0.13 | <0.001 |
| Knowledge about climate change (Q5) | 0.12 | <0.001 |
| Most scientists agree humans are causing climate change (Q4b) | 0.11 | <0.001 |

[42] *Previous studies have suggested that where levels of public beliefs, including scepticism and uncertainty, about climate change differ from those of scientists, it is likely to be at least as much a function of divergent values as of differing cognitive abilities and knowledge (Whitmarsh 2011).*

Table 5b: Multiple regression (using stepwise method) between results of survey question 'Would you be prepared to change your behaviour to help limit climate change?' (Q1) and five survey questions related to attitudes to climate science (Q4a, Q4b, Q5, Q6 and Q10a).

| Prepared to change behaviour to help limit climate change (Q10b) | adjusted $r^2$=0.19 $F_{(4,898)}$=53, p<0.001 | |
|---|---|---|
| **Predictor variable** | **Beta** | **p** |
| Like to read and think about climate change (Q10a) | 0.24 | <0.001 |
| The seriousness of climate change is exaggerated (Q4a) | -0.18 | <0.001 |
| Trust climate scientists to tell the truth about climate change (Q6) | 0.12 | <0.001 |
| Most scientists agree humans are causing climate change (Q4b) | 0.11 | <0.001 |
| Knowledge about climate change (Q5) | not a significant predictor | |

**Conclusions: About one-third of the public trust climate scientists to tell the truth about climate change and about one-third do not trust them. Just over half the public trust independent scientists to give an accurate portrayal of climate change. However, trust in all authority groups to give an accurate portrayal of climate change has seen a significant drop in 2011. Under two-thirds think scientists agree that humans are causing climate change. Measures of public interest, engagement and trust associated with climate science are positively correlated with concern about climate change and willingness to change behaviour.**

## Section 2: Engaging the Public in Climate Science

### 2.1 Reactions to climate science

The focus groups allowed us to explore people's reactions to climate change and climate science in more depth. Key representative quotes from each focus group were collated by the authors of this report from the focus group transcripts and then categorised into common themes. Where appropriate, we have indicated when an attitude or opinion was characteristic of a subgroup of the participants (e.g. those from a particular location or with a particular attitude to climate change). We report those broad themes here, supplemented by examples of quotes from the groups.

- **Many participants commented on the poor communications skills of scientists and their perceived lack of ability to relate to the public**. On the other hand, many of the participants found it difficult to relate to scientists – they viewed them through generic stereotypes and saw them as alien 'others'. Nevertheless, many felt it is important to hear directly from the people who are doing the research. Some felt that science journalists are better communicators than research scientists. The suggestion of having a 'celebrity climate scientist' in whom the public could build trust over many years was often mentioned.

  ***"[Scientists] are not let out very often and when they do talk, they go on. It gets boring. They have to know how to relate to people." (London, mixed causes)***

  ***"Scientists are the ones that know, so they're the best people to tell us. But sometimes they're not because they're not on our level." (Sutton Coldfield, mixed causes)***

  ***"We trust David [Attenborough] because he's been around for 50 years." (Sutton Coldfield, mixed causes)***

- **Many were suspicious of the possible hidden biases or agendas that those communicating about climate change might have**. Politicians and the government were highlighted by many groups as being untrustworthy communicators of information on climate change[43]. Broadly, university-based research was considered to be trustworthy. However, one of the most common sources of distrust of scientific results was related to queries about how the research had been funded; there were frequent misconceptions about this issue.

  ***"The problem is, each person or each group is trying to promote their particular pet project." (Sutton Coldfield, mixed causes)***

  ***"Nobody trusts politicians at the moment, so I think that is the worst person if you want to get something across." (Sutton Coldfield, natural causes)***

  ***"I suppose the universities [give independent advice]. But again, a lot of those are backed by industry now." (Sutton Coldfield, mixed causes)***

- **There is seen to be a lack of consensus in scientific opinion, partly because this is frequently the way climate science is presented in the media**. Many focus group participants thought that scientists are often in disagreement with each other or change their mind over time. This meant they took scientific statements less seriously.

  ***"It's hard to know because it's respected figureheads on both sides of the arguments that bring out these press releases and say that they're right." (London, human causes)***

  ***"They say one thing and then five minutes down the line [they say] actually that wasn't quite right. So you don't know what to believe a lot of the time." (Sutton Coldfield, natural causes)***

  ***"I think it sort of confirms that it's so uncertain. You put ten scientists in a room, you're going to get ten different opinions on this." (Sutton Coldfield, mixed causes)***

- **Some were suspicious about the science itself**. In each of the 'natural causes' groups, one participant briefly mentioned incidents they recalled hearing about where scientific findings had been retracted. However, 'Climategate' was not mentioned directly in any of the focus groups[44].

[43] *See also the survey result in the Appendix (Q7).*
[44] *See also the discussion in Pidgeon (2010).*

*"You can put a program in the computer to give you any given conditions so I was a bit sceptical about that." (Newcastle, human causes)*

*"Last year there was a huge science programme, the research was published and then people started to shoot it down in flames. They had to climb down and say that some of it was falsified." (Newcastle, natural causes)*

*"I know a lot of the science behind [climate change] has been discredited, because they have admitted that they have made some of the figures up." (Sutton Coldfield, natural causes).*

- **Those with more firmly held views about climate change would tend to look for information that supported their own viewpoint** and be frustrated or distrustful if they didn't find it[45]. For some, it was evident that their lack of trust in particular groups when providing climate change information was a reflection of those groups not providing information that was consistent with their beliefs, as has been demonstrated in other studies (Kahan et al. 2011a). Individuals in both these groups also felt that some of the media coverage was 'scaremongering'.

  *"They must know a lot more than they are saying. With science and technology today they must [now] have 99.9% proof, so why can't they just say it definitely is [caused by climate change]?" (Newcastle, human causes)*

  *"Because of my sceptical views with regards to climate change, I will home in on [a headline] that suggests that they are going to blow a myth and tell the truth" (Newcastle, natural causes)*

- **Many put their own interpretation on articles they read in the press, based on their existing attitude towards the newspaper in question**. People were very quick to recognise if a headline was not supported by the body of an article. The BBC was often cited as a trustworthy media source.

  *"I know the Daily Mail's point of view so if I read an article I take that into account and if I really wanted to know about it, I would look at the BBC sites or something which I think would be a statement of facts rather than have a slant." (London, human causes)*

**Conclusions: Scientists were often viewed by focus group participants as being poor communicators and difficult to relate to. Aspects of a climate science news report (other than strict 'scientific' content) that influenced participants' trust in a message included whether or not: a) the messenger (both scientist and media outlet) could be perceived to have an 'agenda'; b) there appeared to be a scientific consensus; and c) the worldview of the participant was aligned with the report.**

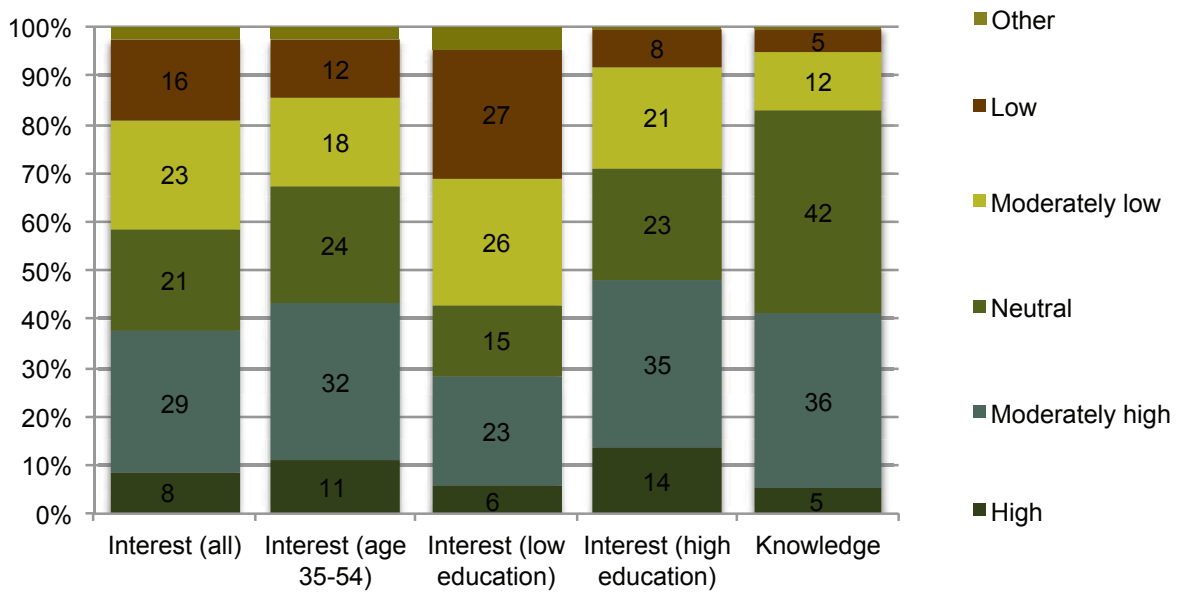
### 2.2 Interest in, and knowledge about, climate change

The quantitative survey provided some insight into areas of interest for different sectors of the public with respect to climate change.

- **Just over one-third (38±3%) agreed that they like to read and think about climate change, while a similar number (39%) disagreed with this statement[46]**. This represents a significant decrease in the number who agree compared with 2010 (46%)[47] and may reflect a certain amount of issue fatigue, as climate change is an increasingly familiar topic.
- **The groups least interested in climate change are those aged 16 to 24 (32% of whom like to read and think about it) and those aged 65+ (31%)**. The most interested group are those aged 35 to 44 (47%). Those with higher educational qualifications are more likely than average to say that they like to read and think about climate change (48%). See Figure 7.

[45] *Psychological research has established that people routinely seek out and accept evidence that supports their existing views, while ignoring or discounting contradictory evidence (Whitmarsh, 2011).*
[46] *Appendix: Q10a.*
[47] *See Cardiff/Ipsos MORI (2010).*

**Figure 7: Level of interest in reading and thinking about climate change (Q10a) in the entire population and within subgroups divided according to age and educational attainment and level of self-assessed knowledge about climate change (Q5).**




*Source: interest in climate change determined by whether participants said they liked to read and think about it (Q10a), where 'Low'='strongly disagree', 'Moderately low'='tend to disagree', 'Neutral'='neither agree/disagree', 'Moderately high'='tend to agree', 'High'='strongly agree'. The segmentations 'low education' = 'no formal qualifications' and 'high education' = 'degree+'. Self-assessed knowledge determined by responses to Q5, where 'Low'='nothing', 'Moderately low'='hardly anything', 'Neutral'='a little', 'Moderately high'='a fair amount', 'High'='a lot'.*

- **In the focus groups, children and grandchildren were frequently cited as a channel through which people engage with science in general**, although in the quantitative survey there was little difference in reported interest in climate change between those with and those without children in their households.

  ***"I'm getting more interested in [science] because of my son, who's at secondary school." (Sutton Coldfield, mixed causes)***

  ***"My son watches a lot of the children's channels and I pick up stuff off the scientific programmes." (Sutton Coldfield, natural causes)***

- **Less than half (41±3%) of respondents to our survey said that they know a fair amount or a lot about climate change**[48]. See Figure 7. This represents a significant decrease compared with the results of several DfT surveys where the percentage who claimed this level of knowledge remained steadily around 53% from 2006 to 2009. A similar question was asked in a repeated Defra poll[49], which also found a significant drop in those who said they knew a fair amount or a lot in 2011 (44%) compared with 2007 and 2009 (61% in both cases)[50].

[48] *Appendix: Q5.*

[49] *A series of opinion polls conducted for Defra from 1986 to 2011 (available from http://www.defra.gov.uk/statistics/environment/public-attitude/ - retrieved 12th December 2011). Hereafter these polls will be referred to as 'Defra (1986-2011)' with the year representing the year the poll was undertaken.*

[50] *The question asked was 'how much if anything would you say you know about the following terms?' 1) CO2 emissions, 2) carbon footprint, 3) global warming, 4) climate change. We have cited the responses to 'climate change', reported in Defra (2007) and Defra (2011).*

- **When people were asked in the survey what things they think contribute towards climate change, they most often stated 'emissions from road transport' (47%)**[51]. This is consistent with a downward trend in the percentage who say road transport contributes towards climate change found in repeat DfT surveys from 2006 (72%) to 2010 (59%)[52]. Just over a quarter (28%) said 'destruction of forests' contributes towards climate change, which is broadly consistent with previous DfT surveys. However, there is substantial variability over time in the responses to similar questions: between 1993 and 2001, surveys by Defra[53] found 'destruction of forests' was mentioned more often than 'emissions from transport'. Moreover, previous studies[54] have found that there is a tendency for people to conflate climate change with other environmental issues and to understand climate change in terms of the broader concept of 'pollution'.
- **Energy use in some form or another was mentioned by almost half (47%) of the respondents as a contributor to climate change** (including emissions from power stations, burning fossil fuels and gas/electricity use)[55]. The British Social Attitudes surveys have found that a large percentage of people (81% in 2000 and 71% in 2010), when prompted, say coal, gas or oil contribute to climate change[56]. However, only 19% of our survey specifically mentioned gas/electricity use at home or by businesses (with less than 15% of those aged 16 to 24 and 55+ mentioning it). Similarly low figures for everyday gas and electricity use have been found in previous DfT and Defra surveys, indicating that these are not, specifically, things that many people immediately associate with the causes of climate change (in part this may be because they are less visual/tangible as 'pollutants').
- **Almost one quarter (24%) mentioned natural causes of climate change**, a significantly larger percentage than has been found in the past[57].
- **When asked what the consequences of climate change are[58], 40% provided only associations to impacts geographically and psychologically distant, generic increases in temperature, or a different environmental problem, or stated that they envisage no consequences[59].**
- **There were five major categories of responses for the consequences of climate change that were mentioned by 20% of respondents or more**[60]. The most common response to our survey was 'more extreme weather conditions' (34%), the value of which has remained broadly constant over time (34% in DfT 2009). There was a significant drop in 'changing global climate' (28%) compared with previous DfT surveys (41% in 2009) and 'changing local weather' (23% in 2011 compared with 31% in 2009). As noted by Spence et al. (2010), there is a great deal of public uncertainty over what the effects of climate change will be. Overall 11% replied 'don't know' to this question, but among those aged 65+ this percentage was significantly higher (18%).

**Conclusions: Interest in and knowledge about climate change is moderate, with less than half the population saying that they like to read and think about it and less than half saying that they know a fair amount. Climate change tends to be conflated with other environmental issues. Few people spontaneously think of everyday gas and electricity use as a contributor to climate change. In terms of consequences, people most readily associate climate change with impacts that are distant in time and space.**

---

[51] *See Appendix Q8; note that respondents were asked, unprompted, to list all contributors to climate change and responses were then categorised by the pollsters. Thus, for example, all replies mentioning roads or vehicles were categorised under 'emissions from road transport'. The categories chosen were as for previous DfT surveys.*

[52] *See DfT (2006-11). Note that caution should be used in comparing our results with these surveys because the context of the DfT surveys was transport, which may have introduced a bias.*

[53] *The question was 'which, if any, of the things listed on this card do you think are major contribuors to climate change?'; see Defra (1986-2011).*

[54] *As summarised in Upham et al. (2009).*

[55] *These values include some that were subsequently categorised by the pollsters as 'other'; see Appendix Q8.*

[56] *See Taylor (2011); percentages refer to those who definitely or probably agreed with the following statement: 'every time we use coal or gas or oil we contribute to climate change'.*

[57] *DfT surveys have fluctuated between 10% in 2006, 16% in 2007, 14% in 2008 and 11% in 2009. An increase in the percentage of people listing 'natural causes' is consistent with the increase in the percentage of people who say that climate change is 'entirely' or 'mainly' due to natural causes (Q3), which has increased from 9% in 2009 to 20% in 2011.*

[58] *See Appendix Q9; note that respondents were asked, unprompted, to list all consequences of climate change and responses were then categorised by the pollsters. The categories chosen were as for previous DfT surveys.*

[59] *Characterised as responses to Q9 coded as any other than: 'changing local weather', 'more extreme weather', 'impact on farming/food production', or 'rising sea level/flooding'. Relatedly, Leiserowitz (2006) investigated the American public's immediate emotional reactions to climate change. Associations to distant events like melting glaciers and polar ice were most commonly mentioned, followed by generic associations with heat and rising temperatures and impacts on nature. Disasters, floods/sea level rise, melting ice, impacts on nature and ozone depletion (the latter being incorrectly attributed) were considered the most negative associations.*

[60] *Responses categorised as 'more extreme weather' (34%), 'changing global climate' (28%), 'rising sea levels' (28%), 'changing local weather' (23%) and 'melting ice caps' (21%). The values given are an average across the two survey runs.*

### 2.3 Interest in climate change news reports

The focus groups provided further insight into what material people found interesting in news reports and how the presentation of the material influenced their level of interest and understanding.

- **Television news was the most cited source of information on climate science (discussed extensively in each group).** Newspapers (either national or local, print or online) were mentioned by all groups, but some individuals said that they did not regularly read newspapers. Four of the groups mentioned radio and two mentioned magazines/periodicals (e.g. The Economist, New Scientist or National Geographic). A number of participants cited articles linked to their email homepage (Yahoo, MSN etc.) or other internet sources such as Wikipedia. Social media sources (e.g. blogs and Twitter) were not mentioned directly. Occasionally, diverse other sources were noted, including product advertisements.
- **It was evident that television documentaries are particularly powerful sources of information**. The format allows the information to be presented in ways that people find compelling and they provide people with facts that can be used later as a framework for interpreting new information (e.g. news items).

  ***"[Documentaries] bring it to life. They have different individuals from different professions giving their opinions and I prefer it that way." (London, human causes)***
- **When the participants were asked what comes to mind when they hear the expression 'climate science', the responses were typically a range of environmental issues and natural hazards**. So, although they would say weather and extreme weather, sea level rise, flooding, carbon footprint, greenhouse gases, carbon dioxide, ice caps and deforestation, they would also say ozone, volcanoes, tsunamis, earthquakes and recycling. This is consistent with the results of the quantitative survey.
- **Participants were most interested in science that was presented in a way that related to aspects of their lives**. Diverse examples were mentioned and included: solar panels and ground pumps (cited by a plumbing and heating material salesman), bees (a golf club committee member who had been asked to install beehives on their golf course), hurricanes (someone had been caught in one), electric cars (someone's passion was cars), environmental health effects (an asthmatic) and Amazon deforestation (someone's parents originated from the region). Some participants expressed particular interest if the story was framed in a way that indicated a money-saving aspect.

  ***"It was actually quite interesting because it is about Britain and also an article about North Tyneside." (Newcastle, human causes)***

  ***"I think they need to come at an angle that people are interested in, so if it's polar bears, natural habitat then so be it, as opposed to just talking about rising sea levels which doesn't really impact people's day-to-day working lives. You're not sat beside your computer thinking 'oh gosh, how many millimetres is the water going to increase by'." (London, human causes)***

  ***"If it was something that I really knew would save me money, I would home in on that." (Newcastle, natural causes)***
- **Participants more frequently chose articles related to the UK (26 articles chosen) than those related to global aspects (17 chosen)**. Half of the articles available concerned UK future projections, UK extreme weather or wildlife relevant to the UK (e.g. bees), while the other half were more focused on global climate change. See Table 3.
- **Participants showed increased interest in articles that were relevant to their local area**. Stories about floods were of particular interest to the groups from regions that have experienced flooding in recent years[61]. There were five articles on flooding available for selection and these were chosen most often by the groups from Newcastle (six times), then the Sutton Coldfield groups (three times) and least often by the London groups (once), with many of those who chose these articles specifying local connection as being the reason for their interest.

[61] *A recent study has shown that those who report experience of flooding express more concern over climate change, see it as less uncertain, feel more confident that their actions will have an effect on climate change and have a greater willingness to save energy to mitigate climate change (Spence et al. 2011).*

*"I think if it is local to you it is definitely more interesting because you can identify with it." (Newcastle, human causes)*

*"The floods in the Midlands – if they base [articles] around something that's topical or relevant, locally, I think they will engage people." (Sutton Coldfield, mixed causes)*

- **Many participants automatically associated 'science' with school** (and negative impressions such as 'geeky' and 'boring') but many went on to say that they have discovered that science can be relevant to everyday life and have come to find it more interesting.

  *"I would have thought you stop thinking about science when you leave school, but I think you find it every day." (London, mixed causes)*

  *"I haven't passed an exam in my life but I am quite interested now. You learn as you get older." (Newcastle, human causes)*

- **News reports were considered more interesting if they contained a strong narrative**, e.g. they were dramatic, they could be linked to a compelling and easy-to-understand description or they told the story of a personal experience.

  *"We've chosen [to read articles that describe] quite dramatic changes that we can visualise and understand: with the polar bears, the ice is melting and they can't survive because they need the ice to live on and that's happening really quickly, so that affects them." (London, mixed causes)*

  *"You can relate to it a little bit more because he [TV presenter Bruce Parry] is actually going and meeting these people and sharing their experiences." (London, mixed causes)*

- **Participants generally expected something 'new' in a news report** and were disappointed if they didn't find it. Information that scientists might consider new did not necessarily correspond to what the participants considered new (e.g. a new scientific study that quantified the increased likelihood of the Autumn 2000 floods in the UK as a result of climate change, which participants felt was old news) and vice-versa (e.g. an article describing how climate change could result in higher night-time temperatures, which the participants considered new information).

  *"It [a report about flooding] was old hat. It was like 'tell us something we haven't heard before'. I hate to put the news on and listen to a story that is basically how many years old?" (Newcastle, natural causes)*

  *"We didn't know about this [night-time temperature increase]. I found it interesting because I hadn't heard of it." (Newcastle, natural causes)*

- **Some participants, irrespective of their attitudes to climate change, disliked 'negative' stories and preferred 'non-alarmist' presentational styles.**

  *"To say the world is going to end, people just switch off thinking 'here they go again, trying to sell us something'." (Sutton Coldfield, natural causes)*

  *"I quite like the positive. We've heard so many negative things about climate change, even though it didn't say we were okay, it was not alarmist." (London, mixed causes)*

- **Many participants wanted to see passion and conviction from scientists**. They did not find the calm and rational manner of many scientists compelling. It appeared that the participants used the signals that they have learnt to process in their daily lives, such as passion for a subject, as evidence of the trustworthiness of the communicators.

  *"I would feel a bit better if the scientists said 'I believe in my heart of hearts that this is going to happen'." (Sutton Coldfield, natural causes)*

  *"They've got to be able to bring out some emotional part of what the facts are." (London, mixed causes)*

- **Participants wanted to know how they might use the scientific results** and their level of interest diminished if that information was absent.

  *"Why would I be requiring this information? I have got no call for it." (Newcastle, human causes)*

  *"They can keep feeding the information, but what as individuals can we truly do about it?" (Newcastle, natural causes)*

**Conclusions: Television was the source of climate science news most cited by focus group participants. Television documentaries can provide critical background information to later engage people in news reports. Features of a news report that make it more interesting to people include: a) relevance (stories related to UK future projections, to UK extreme weather and to UK wildlife were preferred); b) a strong narrative; c) 'new' information, including a new angle on established information; d) positive stories; e) non-alarmist but passionate delivery of the information; and f) the inclusion of information concerning how people might use the scientific results.**

## Section 3: Communicating to the Public about Climate Science

### 3.1 Clarity of content

The focus groups also provided insight into which aspects of the content of a climate science news item were or were not compelling.

- **When asked how they might improve a news report, five out of six of the groups[62] suggested the inclusion of more explanatory diagrams and graphs**. This was seen as being more useful than generic pictures. However, such graphics need to be straightforward (see below).

  ***"The article could be improved by the use of more explanatory diagrams - you are more interested and you can see it." (Newcastle, natural causes)***

  ***"I thought that was quite difficult [to understand] and I think [it would be better] if they had some kind of visual, a diagram or a graph or maybe even a picture just to show us what that means." (London, mixed causes)***

  ***"I like it when Channel 4 News gets a diagram out and they kind of talk about it - they illustrate what they're talking about." (London, mixed causes)***

  ***"The picture was of the Earth, whereas maybe they should have done a graph of how [the temperature had] decreased." (London, mixed causes)***

- **Pictures were seen as being good for attracting attention, but graphics which were complex or not explained were considered off-putting**. One of the television news reports[63] had scientists discussing their results, while cutting in and out to a (poorly explained) computer animation in the background. The participants found this very confusing because there was too much information for them to concentrate on.

  ***"A nice picture or something attention-grabbing compels you to read a bit." (London, human causes)***

  ***"You find yourself getting drawn to looking at those arrows [in a computer animation on a BBC TV report] and trying to find out what they actually mean, without listening to him." (London, mixed causes)***

- **Participants wanted more use of simple language and everyday examples**.

  ***"[Scientists] all speak the same language which for me isn't easily digestible. You have to use the correct terms and you do have to give people some credit that they will understand..." [Another participant:] "…but some things could be more simple." (London, human causes)***

  ***"I think it's more credible coming from scientists but I think at the same time it's important for them to give examples to relate to what they're saying so you understand it, not necessarily simplify the way they say it, but relate it to the individual." (London, human causes)***

- **Where numbers were given, the participants wanted an indication of what that number implied**. In addition, too many numbers (or too many facts given in a short space of time) were very off-putting and confusing.

  ***"It says 'the long-term rate of global warming has been around 0.16°C a decade'. [They need to] put that into perspective so I can relate to it more on a day-to-day basis – I know what it means, I understand the figure, but I can't compare it to anything." (London, human causes)***

  ***"They said 'there is still a warming trend over the ten years since 2000 and the decade was the hottest on record'. I didn't understand really what this meant but I would have if they'd given me an example like, July 2000 this happened and so many people found it so hot whereas 2010 July was not as cold or as hot." (London, human causes)***

[62] *London mixed causes (spread of education levels), London human causes (A-Level or degree), Sutton Coldfield mixed causes (spread of education levels), Newcastle natural causes (GCSE or no formal qualifications), Sutton Coldfield natural causes (A-Level or degree).*

[63] *'Climate change raises flood risk, researchers say', BBC News, 16th February 2011, http://www.bbc.co.uk/news/science-environment-12487913*

- **Whatever their educational background, the participants were most willing to accept a piece of information if a statement was backed up with a simple explanation of a mechanism that they could understand**. They disliked statements that gave no explanation.

  ***"It is not using words like you haven't got a clue what they are on about. It is easy words. It is basically telling you that [the cold winter in the UK in 2010/11] is because of the Arctic, the ice melting, which is making warm water hit cold water." (Newcastle, human causes)***

  ***"According to this the aerosol gases have got a reflective power and it is reflecting the heat back off the sun so it is actually cooling it down." (Newcastle, human causes)***

  ***"It's very simple science. It is basic common sense and tells you that lack of bees means lack of pollination." (Sutton Coldfield, natural causes)***

  ***"They start off by saying there are 'complex interconnections in the climate system', but they don't explain how. They just tell you there are. And then they go on and say they've discovered a 'powerful feedback mechanism'." [Another participant:] "But it doesn't say what that feedback mechanism is." (Sutton Coldfield, mixed causes)***

- **A short report entitled 'Bee loss caused by climate change may hit plants' (Daily Mirror, 6/9/2010) was the most popular among the focus group participants** (chosen by five of the six groups). It was praised for being "straightforward", "common sense" and "interesting because it talks about the food chain". It mentioned a science journal article and a 17 year study, both of which were seen to be authoritative. In addition, many participants had seen television documentaries about the decline in numbers of bees and so they felt that it related to something they already knew[64].

  ***"It was precise, it was clear, to the point, there was no use of technical jargon in it. It was very easy to understand and it just told the story." (London, mixed causes)***

  ***"One sentence: 'without bees and other pollinators, many types of fruit and vegetables may not exist'. That's quite a sobering thought." (Sutton Coldfield, mixed causes)***

  ***"I saw a documentary on the bumble bees. Our local shop was actually giving plants to their customers free, seeds, plants that attract the bumble bees so I have got them." (Newcastle, natural causes)***

- **Indicators of change were seen as particularly convincing**. In the case of the report about bees, the bees were seen as being 'without an agenda' and therefore a more trusted source of information, even among those sceptical of a human influence on climate change.

  ***"I think that people are beginning to appreciate that certain things are indicators of change and that is why I would have an interest. A declining bee population may not necessarily be as a result of climate change but it's an indication of climate change." (Newcastle, natural causes)***

- **Certain words, phrases and metaphors were not understood** (see Table 6). One example which, despite being recommended for use in science communication (Hassol 2008), caused widespread confusion was "loading the dice", which was used to describe the increased chance of flooding as a result of climate change. Many simply didn't understand the expression, others couldn't work out why dice were appearing in a report about climate change and some thought something entirely different was being said.

  ***"Interestingly it said that they have loaded the dice to get the result they want, but the results don't tell them if it does actually happen. So they have tried to cheat, but can't." (Sutton Coldfield, natural causes)***

[64] *Some participants criticised the article for not including much detail concerning the mechanism by which climate change may result in a decline in bees, and the phrase "may have declined" was taken by some to mean that the scientists had not measured the number of bees properly. These criticisms reflected more general criticisms of news items as outlined in this section.*

**Table 6: Words, acronyms and phrases found in newspaper articles that were not understood and were highlighted as such by participants on feedback forms.**

| Selection of words and phrases highlighted by participants as not being understood | | |
|---|---|---|
| Anthropogenic | Aerosol | Stratosphere |
| Complex interconnections | Transient phenomenon | Urban heat island |
| Adaptation | Hemisphere | Lower latitudes |
| Multi-decadal oscillation | Multiple datasets | NOAA |

- **Participants chose 'tabloid' articles (28 chosen) almost twice as often as 'broadsheet' articles (15 chosen)**, although there were equal numbers of tabloid and broadsheet articles to choose from[65]. The tabloid articles were popular even among those who said they would not normally read them.

  ***"I read papers like the Guardian although I tend to ignore the scientific parts. But in terms of information I found [the Daily Mirror article] captures your attention. It's just to the point. I'm really interested in science and what goes on around the world, but what I don't like is technical jargon. I run a mile from it." (London, mixed causes)***

**Conclusions: Focus group participants wanted more simple diagrams or graphs to explain stories, they appreciated simple language and everyday examples, where numbers were included they wanted them put in context, and simple explanations of mechanisms that could be easily understood helped to build trust in a story. They also found 'indicators of change' compelling because these were seen as factual and impartial. 'Tabloid' articles were popular even among those who said they would not normally read them.**

### 3.2 Construct of communications

There were a number of generic aspects of news reports that led to considerable discussion in the focus groups. Below is a summary of each of these aspects.

#### a) Communication of uncertainty

Participants in each of the focus groups appeared very sensitive to the use of descriptions of uncertainty and were particularly drawn to words such as 'could', 'may' and 'suggest'. These were generally used in news reports to signify scientific uncertainty[66], but were often interpreted by the participants more as expressions of ignorance (i.e. total lack of knowledge). A typical comment was:

***"It [a newspaper article] was in one line saying humans' influence on climate change was doubling the risk [of flooding] and the next minute it was saying [scientists] weren't sure how much humans had influenced it [in reference to the quote 'we can't with absolute certainty say exactly how big the influence of humans is' from a scientist]." (Newcastle, human causes)***

These terms of uncertainty were picked out and commented upon as the scientists "sitting on the fence", the news report not being "conclusive" and "lacking facts". This led to much frustration among the participants who wanted definitive statements.

***"Feels like a waste of time that you will never get back if you're reading hypotheses all day long." (London, human causes)***

***"There was not enough evidence. It was fairly vague, 'the finger of suspicion points this way', but there was no actual evidence to point to things. It was pretty boring." (Sutton Coldfield, mixed causes)***

[65] *In our study, the 'tabloid' group was defined as (Daily Mirror, Sun, Daily Express and Daily Mail) and the 'broadsheet' group as (Times, Sunday Times, Independent, Financial Times, Sunday Telegraph, Daily Telegraph and Guardian). The total average daily circulation in 2011 of the newspapers from which the articles were taken was 2 million (broadsheets) and 7 million (tabloids); figures from the Audit Bureau of Circulations.*

[66] *Generally the words were used to represent probabilistic information (i.e. aleatoric uncertainty) and sometimes a degree of incomplete knowledge (i.e. epistemic uncertainty).*

It was also clear that the context mattered. Many of the participants felt that there were reasons other than climate change for the recent flooding events and so were unmoved by the suggestion that there 'may' be a climate link.

> ***"I just think it's a case of blame it on climate change. There's always been floods in the UK, floods 20, 30, 40 years ago, 100 years ago, was that to do with climate change?" (London, human causes)***

On the other hand, many people had heard that bees were in a plight and so were much more willing to accept that there 'may' be a climate link in that instance: it connected better with their personal experience. Note that the framing of the statement of uncertainty (the article about bees stated "scientists fear it may be due to climate change") may also have influenced the way it was perceived[67].

**b) Inclusion of 'facts'**

Participants frequently mentioned that they wanted more facts and fewer opinions. Observed changes can often be expressed as definitive statements and these were seen as more compelling than future projections, which necessarily have to be expressed in uncertain terms.

> ***"I thought the beginning [of a BBC TV report] was good. [The Government Chief Scientist] was factual. He was like - the temperature has risen by that much, the carbon dioxide has… - I thought that was really good." (Sutton Coldfield, mixed causes)***

> ***"The whole article is based around people's opinions, there are no actual facts." (Sutton Coldfield, natural causes)***

**c) Multiple voices and 'balance'**

The attitude to the presence of multiple opinions in news reports was very mixed. A few liked to hear different viewpoints, but the majority found it confusing. If a participant felt that a contributor confirmed their own opinion, they would tend to pay more attention; if not, they would tend to ignore the contributor. For most of the participants, though, the dominant cause of confusion arose from the statements of scientific uncertainty noted above. Such statements left the participants unsure what they were supposed to conclude.

> ***"I think it is important to have varied viewpoints but ultimately they're all saying the same thing which is they're not sure, they can't say for certain that it's due to climate change or it's actually natural. So whether the sceptic's on it or not, to me it doesn't really make a difference." (London, human causes)***

> ***"I formed my opinion anyway so somebody comes on like [a sceptic] and says what he says and I dismiss him anyway." (London, human causes)***

> ***"I want to believe that it's not having an effect. You tend to latch onto people like [the sceptic] because you think perhaps it's not so bad after all." (Sutton Coldfield, mixed causes)***

Some commented that it was difficult to assimilate a written article if it was filled with too many names of different scientists and/or quotes.

> ***"Names are nothing to me." (London, mixed causes)***

> ***"They introduced names of professors… it gets in the way of the story." (Newcastle, human causes)***

**d) Narrative**

Participants preferred a strong narrative in a report, with a clear concluding statement, rather than the traditional journalistic 'inverted pyramid' style (although this preference may have been influenced by the fact that participants were asked to follow a report to its end).

> ***"I almost feel like a lot of people writing newspapers nowadays have forgotten the art of story telling – telling where they are, telling you what's going on in the middle and concluding." (Sutton Coldfield, mixed causes)***

[67] *Risk perceptions are known to be influenced by emotions (see e.g. Leiserowitz 2006) and thus the use of a 'fear'-based framing may have influenced the way the statement was perceived.*

*"By the end of [the BBC TV report] I went off somewhere else. I don't know if it was because it was too much going on and too much information or what, but toward the end I remember thinking I have lost what this is about." (Newcastle, human causes)*

*"There is no for and against in it [a newspaper article]. It doesn't answer any questions." (Sutton Coldfield, natural causes)*

**Conclusions: It is challenging to communicate effectively the uncertainty that is inherent in many scientific results. The word 'uncertainty' is frequently misinterpreted by lay audiences as implying ignorance. Focus group participants were looking for definitive statements and were very sensitive to the use of words such as 'could', 'may' and 'suggest'. Many found the inclusion of multiple viewpoints in a news report confusing. Reports that contained a strong narrative with a clear conclusion were preferred.**

### 3.3 Key criteria for news reports

In this section, we report the impressions that the moderators of the focus groups had concerning the way in which the participants typically approached a news report. Since these impressions are subjective, we present them as a hypothesis that could be tested more rigorously in a controlled setting.

In general, the participants tended to approach a news report in three stages, which encompassed a number of different criteria, as outlined below. Stage one was apparently crucial as it identified whether the news report was relevant to individuals. It was the point where the decision was made to pay attention to the report or ignore it. The subsequent stages, if reached, focused on building on and consolidating the message presented in stage one.

**Table 7: Stages in which focus group participants approached news reports.**

| Stage one: Attraction | Stage two: Attention | Stage three: Consolidation |
|---|---|---|
| 1. Interest & relevance | 5. New information | 9. Summary |
| 2. Headline | 6. Points of view | 10. Take-home message |
| 3. Source | 7. References | |
| 4. Images | 8. Language & style | |

*Source: GfK-NOP focus group moderators.*

#### Stage one: Attraction

The criteria that determined whether participants were attracted to a news report were very general and often related to its visual appearance. These factors were more important when evaluating newspaper articles than TV (and radio) news items.

1. **Interest & relevance**. Reports that made explicit references to everyday life up-front were particularly good at engaging participants. Examples included: real-life stories; everyday issues; local relevance; and animals.
2. **Headline**. For newspaper articles, headlines were used to assess whether the articles were likely to contain a new piece of information or discuss a topic that interested the participant, e.g. many participants chose an article that mentioned bees in the headline as this was of interest to them. It was assumed that headlines related to the content of the articles they were about to read (although this was frequently found not to be the case).
3. **Source**. Knowing the source of each news item (i.e. which newspaper or broadcast channel) helped participants decide whether they would like to read/watch/listen to the item. Participants tended to make a judgement on the content, style and trustworthiness of the item based on the source alone.
4. **Images**. Generally, participants welcomed pictures and diagrams to make the items more appealing (climate science newspaper articles were often thought to be text-heavy) and to aid clarity (there were a number of requests for more charts, diagrams and graphs to explain the information). However, some news items were criticised for including generic climate science images that did not relate to the content of the story being reported.

### Stage 2: Attention

Once participants had chosen to read/watch/listen to a news report about climate science, some found themselves losing concentration or interest in the story. A number of issues relating to the presentation determined whether the report kept the participants' attention.

5. **New information**. Participants were generally searching each news report for the 'new' information it was communicating. Each newspaper article was read on the basis that it would explain something new. Often participants were disappointed as they were unable to locate the new piece of information amongst the background/context, which often appeared to be 'old' news, e.g. discussions about whether climate change was happening.
6. **Points of view**. Often a news report presented two or three different perspectives, making it difficult for participants to know which evidence they should believe. Participants often interpreted statements of uncertainty as indicating inconclusiveness and thus these were not considered 'newsworthy'.
7. **References**. Participants were not familiar with the scientists (or often the institutions) named in articles (frequently a number were quoted in a single article). This sometimes led to participants lacking enthusiasm for a report because they felt distant from the evidence being mentioned.
8. **Language & style**. The language used to communicate the climate science was often too technical for the majority of the participants, which created gaps in their understanding of a news report. Participants lost interest in reports that included complex language or convoluted descriptions. Simple messages were preferred, particularly if they placed the key points in a real-life context to assist understanding.

### Stage 3: Consolidation

During the research, all participants were encouraged to read/watch/listen to the whole of the news report they were reviewing, whereas normally they may not have persevered until the end. The final stage of engagement of the participants with the report involved consolidation of the key message(s).

9. **Summary**. The end of the reports were often criticised for not summarising the main point of the report. Without this extra guidance, participants were unsure and confused about what the main points were (especially as a number of articles included several different perspectives on the same issue).
10. **Take-home message**. Participants were expecting to be told 'how the story ends', but many articles finished with an uncertain point of view that was open to interpretation. Ideally, participants were looking for some indication of the implications of the research for their own lives. Many reports were framed around the question of whether humans are causing climate change and that meant that the implications were often lost amongst the debate.

**Conclusions: Focus group participants found news reports to be most engaging when they had a 'storybook' structure including certain key elements. Popular news reports had an obvious relevance to the audience and peripheral aspects such as the headline, the source and any associated images were important for attracting attention. Participants liked new information to be highlighted and differing points of view to be introduced with care so as to maintain a simple flow. The language and style of reports were sometimes alienating. Finally, they wanted a summary of the key points and a clear take-home message.**

## Section 4: Comparison of Attitudes to Climate Change and Climate Science among Academics and the Public

Two additional focus groups were undertaken with academics: one with scientists and one with arts/humanities researchers. These followed a very similar format to the focus groups containing members of the general public. The focus groups with academics were experimental and a more extensive study would be required to draw robust conclusions, so the results included here are purely indicative. All the academics were from the University of Cambridge and none worked directly on climate science.

These additional focus groups revealed similarities and differences between the general public and the academic groups, and between the science and arts/humanities groups, in terms of their attitudes to climate science and reactions to climate science in news reports.

### 4.1 Attitudes of academics to climate science and their reactions to climate change news reports

- **Broadly, as with the general public, the participants in the academic focus groups engaged with climate science through aspects that were relevant to their daily lives (including their professional experiences)**. The reasons cited for being interested included concern for their children's future, links to their own areas of research, or connections to their other interests (e.g. wine-making in Kent).
- **However, both groups disliked hard news being mixed with "entirely gratuitous or essentially human interest" elements that reduced the scientific information to a minimum and appeared to be designed as "entertainment rather than news"**. The science group was uncomfortable with climate science being defined to include the 'impact on people, wildlife and society' as they felt this "went a long way downstream" to the "soft, people end of things".
- **When asked about their attitudes to climate science, the scientists tended to discuss it in a framework that was relevant to their own subject of research**. This often led them to be critical of the science when they perceived it not to follow the same practices as their own specific discipline, e.g. in terms of the statistical significance required to claim a result, the need to conduct controlled experiments, or the limitations of computer modelling.
- **On average, participants in the arts/humanities group said they had moderate-high interest in climate science, while those in the science group said they had moderate interest**. One arts/humanities group participant admitted to feeling "guilty" at not being more interested in scientific matters in general, another noted that "there is a difference between being 'aware of and interested' and 'aware of and sufficiently interested to then go and follow anything up'", while a third noted that they had never had "a heated discussion on climate change with friends or colleagues".
- **Participants in the arts/humanities group felt that their own scientific expertise was not sufficient to judge the scientific arguments but that they were prepared to take some information on trust**, if they could determine that there was a balance of accepted opinion coming from people in institutions and bodies which they considered to be "credible". However, they wanted to see interviewees challenged more.
- **Participants in the science group emphasised the fact that "a scientist is naturally a sceptic" and they did not take any information on trust, whatever the source**. Instead they typically started from a position of scepticism about a scientific statement and in general felt that there was not sufficient information in a news report to convince them otherwise. This led them to be suspicious of much of the scientific work being presented. They were particularly circumspect, for example, about whether a single episode of flooding could be attributed in any way to climate change.
- **Both groups commented on the lack of scientific detail in news reports**. As with the general public, the participants thought that some news reports could be improved by the inclusion of charts and graphs to explain concepts and data.

  ***"Science is being invoked rather than actually being used to demonstrate anything." (Arts/humanities group)***

  ***"The way the media treats [climate science] is that there is very little of the science that actually gets in there." (Science group)***

*"I have taken an intelligent interest in climate science, but the media tells us so little that I find it very difficult to know what is the truth whenever a technical claim is made." (Arts/humanities group)*

- **Both groups noted that many of the news reports were confusing and lacked logical lines of argument, and that frequently conclusions were given without providing any information about how those conclusions had been reached.**

  *"I am more concerned with the illogicality or the irrationality of how the article has been done." (Arts/humanities group)*

  *"What you get is the headline, or a précis of a press release – sometimes from an environmental group, sometimes from a more respectable research source – but there is very little of the science and the data that is there." (Science group)*

- **Both groups criticised the BBC and other media sources for presenting a "false balance**". The groups also found the presentation of arguments as black and white to be unhelpful. Some of the newspaper articles were praised for being (surprisingly) fair and balanced in their content as a whole, but there was concern that the headline and structure of the article could lead readers to receive an unbalanced message. The science group in particular held a view of the media that led them to be surprised that there were no news reports in the selection with "an out and out denial of climate change or an out and out denial of the human input".

  *"I find it shocking that the BBC's view of balance is getting arguments without logic and people without any proper data, which they like to balance in the editorial view against people who know what they are talking about." (Arts/humanities group)*

  *"Like everything else presented in the media, it is always divided into the pros and cons. It is very un-nuanced." (Science group)*

  *"We all felt that the articles themselves weren't actually that bad…but the headline screams out. In a sense the slant is put on by the newspaper rather than the journalist." (Science group)*

  *"I am worried that some readers will only read the first two paragraphs. You actually had to read the last two paragraphs to get the balanced bit." (Science group)*

- **Some of the 'tabloid' articles were praised by both groups for being clear, logical and easy to understand.**

  *"In a small number of words [the article 'Flooded by man' in the Sun] conveys the key messages of the research that underpins the story and it has very straightforward statements." (Arts/humanities group)*

  *"The article ['Global warming will give Britain longer, colder winter' in the Daily Mail] was well done. It is an interesting and unusual topic. I thought it was easy to understand and it is information-rich." (Science group)*

- **Both groups commented extensively about the uncertainties inherent in scientific results and the challenges of communicating such uncertainty to the general public**. Several commented on the need to educate the people about the nature of scientific uncertainty. The opinion that journalists "should know that no scientist will say anything with certainty" was also expressed.

  *"Most people don't understand the sort of statements that scientists can make and the sort of definiteness with which they can speak, so they are always going to come across as somehow hedging." (Arts/humanities group)*

- **Both groups commented that there are some scientists who are extremely capable communicators and many who are not**. Brian Cox was given as an example of an able science communicator.

  *"The science community needs to think very, very carefully about whom it mobilises. It is not always the case that the lead researcher in a group is actually the person who can do it [best]. People are not listening or reading with a view to picking out a complicated but convincing argument." (Arts/humanities group)*

- **Aggressive interviewing of scientists was disliked by both academic groups and the general public.** A radio interview of a climate scientist by John Humphrys on the BBC Radio 4 Today programme[68], used in one focus group with the general public (London, mixed causes) and in the two academic focus groups, was felt to exemplify this.

  ***"I felt [John Humphrys] was interviewing a politician rather than a scientist." (London, mixed causes)***

  ***"I thought [the interviewee's] ability to maintain her composure was admirable. I think she had an interesting story to tell but it was ruined by John Humphrys." (Arts/humanities group)***

- **Equally, all groups were critical of scientists providing too technical an argument**. This was felt to be true of the Today programme interviewee who was said to have included too much detail (especially numbers) in a style more suited to a professional audience.

  ***"She was talking so fast as though she was talking to an audience of other scientists." (London, mixed causes)***

  ***"The message did not come out loud and clear, unless you were listening carefully." (Arts/humanities group)***

  ***"She provided what I think was a fairly technical argument in a rather technical manner." (Science group)***

**Conclusions: The academic groups, like the general public, engaged with climate science through aspects that were relevant to their own lives. Both academic groups disliked gratuitous human-interest aspects of news reports, felt many reports lacked necessary detail and logical lines of argument, criticised the media for "false balance" in reporting and recognised the challenges of communicating science (in particular scientific uncertainty), but felt the media was partly to blame for the failings. There were differences between the two academic groups, e.g. the arts/humanities group felt that they did not have the expertise to judge the veracity of climate science information but placed trust in respected institutions whereas the science group were inherently sceptical of information, whatever the source.**

### 4.2 Priorities of the different sample groups

Reviewing the sample groups that took part in this research (general public, arts/humanities academics and science academics), each appeared to have some different priorities.

- **The general public wanted something newsworthy**. They were looking for 'new news' that was relevant to their lives. They wanted to know the key message so that they could understand the purpose of the news item and would search for additional details to enhance their understanding of the key message.
- **Arts/humanities academics wanted a structured argument**. They were more concerned with the structure of reports and the way information was presented. They wanted the scientific evidence to be explained but also wanted to see those presenting the science to be appropriately challenged by interviewers.
- **Science academics wanted facts and evidence**. They were concerned about the new information contained in the news reports and the evidence/references that backed it up. They wanted to find out about the science and the research that had led to the finding or discovery.

**Conclusions: The focus groups with the general public and the academics highlighted that, although there are similarities between the groups, there are also differences in terms of their priorities with regard to a climate science news report. While the highest priority for scientists was facts and evidence, those academics in the arts/humanities were looking for a structured argument while the 'lay' public saw something newsworthy as the top priority.**

[68] *'Global temperature "still warming"', BBC Radio 4, the Today programme, 26th November 2010, http://news.bbc.co.uk/today/hi/today/newsid_9231000/9231192.stm*

# Discussion

Over the past decade or so, there has been a move away from attempts to force an improvement in the public understanding of science per se. Instead, an approach that aims to engage the public in science in a manner that emphasises dialogue and personal connection has been promoted as a more constructive strategy, although there is some evidence that this approach has not yet been fully embraced by the scientific community (e.g. Royal Society 2006). This report has attempted to explore aspects of how engagement through the news media may be achieved.

The majority of the UK public believe the world's climate is changing. However, over the past five years the proportion of the UK public who feel the seriousness of climate change has been exaggerated has increased and the level of concern among the UK public has decreased (as has willingness to change behaviour to limit climate change). At first this may seem an unfortunate state of affairs and, at least in part, appears to highlight the failure of climate scientists to communicate their results effectively. However, the reality may be more complex.

**There is evidence from the field of psychology that the public tends to have a 'finite pool of worry' (e.g. Weber 2010) such that increased concern about one aspect of their lives leads to decreased concern about other aspects, and that 'issue fatigue' can set in (Pidgeon 2010)**. Furthermore, a recent study of public opinion over the past decade in the US (Brulle et al. 2012) concluded that access to scientific information has had only a minor effect on public concern, while advocacy by politicians and campaign groups has been a critical influence. Indeed, there is evidence to suggest that cultural values have a bigger effect on perceptions of climate change risks than science literacy or numeracy (Kahan et al. 2011b).

**In addition, increased discussion of climate change policy may have led to a greater prevalence of so-called 'cognitive dissonance reduction', whereby people modify what they believe when they are faced with difficult decisions which entail changing their behaviour/lifestyle at some fundamental level (Whitmarsh 2011)**. The UK public may also be reflecting on the social, economic and political state of the debate – for example, a decline in willingness to change behaviour may result from a rational assessment that the challenge requires more collective action enforced by states rather than relying on the cumulative effect of individual consumer choices (Kahan et al. 2011b).

The changes in climate that have occurred to date can be determined by scientists through global analysis[69] but are difficult/impossible to detect and track by most individuals in the UK based on personal experience, observation and inference. Whereas scientists in their professional life strive to employ analytic processing in their decision-making, the majority of non-scientists rely on a combination of analytic and so-called associative, affective processing[70] (Weber 2010). This means that much of the evidence base that scientists consider to be compelling does not map well onto the decision-making framework of the lay public where this is based on personal experience[71]. **In combination with adverse reaction to a sometimes alarmist framing of climate change in the media, the lack of personal experience of climate change may in part explain why such a large percentage of the public believe that the seriousness of climate change has been exaggerated (Whitmarsh 2011)**.

Climate science communication has the potential to influence, at some level, the public's understanding of, perception of and engagement with the subject of climate change[72]. **However, behavioural psychologists note that while it may be laudable to attempt to raise the level of public knowledge of climate science, it is unlikely on its own to result in altered attitudes to climate change for all but a small subset of the public (Moser 2010)**. A reasonable and realistic goal of climate science communication might be to provide information that is necessary, if not sufficient in itself, for the public to make informed choices.

**Our survey indicated that levels of self-reported knowledge of, and engagement with, climate change in the UK are moderate**, with less than half the population saying that they know a fair amount and less than half saying that they like to read and think about it. For most people, their knowledge of, and exposure to, climate science is obtained through news coverage, documentaries or school classes (either directly or via their children/grandchildren).

[69] *See, for example, Blunden et al. (2011).*
[70] *This is an automatic basic human ability that means, for example, that adverse experiences are linked to feelings of fear and anxiety, which then influence decisions. It is fast, vivid and powerful, usually dominating over analytic processing.*
[71] *Where people report having personal experience of flooding in their local area, for example, they have been found to express more concern over climate change and see it as less uncertain (Spence et al. 2011).*
[72] *Here 'understanding' is taken to mean acquiring and employing factually correct knowledge, 'perception' means views and interpretation based on beliefs and understanding, and 'engagement' means a state of personal connection that encompasses cognitive, affective and/or behavioural dimensions (definitions following Wolf and Moser 2011).*

From the focus groups conducted for this study, it was evident that television documentaries can provide critical background information for the public that enables them to later engage with news reports. However, the lack of personal experience of climate change means that 'attention' and 'trust' become two critical ingredients for the public if they are to incorporate the information into their beliefs about climate change (Weber 2010). **Both the level of attention that a person gives to a risk and the level of trust that a person will afford a communicator of information related to that risk depend on social and cultural factors, such as the person's fundamental values and worldview (Kahan et al. 2011a)**. The survey of UK opinion conducted for this study showed that trust in all groups to give correct information about climate change has seen a significant drop in 2011, although this may in part be due to a general diminution in trust as a consequence of a range of external factors.

**Our survey also indicated that only just over one-third of the UK public trust climate scientists to tell the truth about climate change and about one-third distrust them**. This is a difficult result to interpret, in part because the framing of the question may lead some to conclude that climate scientists must have a vested interest in climate change and therefore be untrustworthy. In addition, there is little historical data to determine whether a change has occurred over time. However, in the wider context, surveys indicate that more than two-thirds of the UK public trust scientists to tell them the truth generally (Ipsos MORI 2011), which suggests that the current level of public trust in climate scientists is comparatively low.

**We found there to be a correlation between the level of engagement the public has with climate change as a topic, trust in climate scientists and the scientific consensus, and attitude to climate change**. The cause/effect could not be determined from our survey data and indeed previous studies (Kahan et al. 2011b; Whitmarsh 2011) have suggested that ignorance or misunderstanding on the part of the public may be less important than political beliefs and values in determining their attitudes to climate change. Nevertheless, the result provides an incentive to focus efforts on communicating the science in open and transparent ways. **It suggests that a move away from the one-way communication 'information deficit' model approach to embrace instead two-way engagement approaches may help foster a more trusting relationship between the public and scientists**.

Our survey indicated that the UK public most readily associate climate change with highly visual and obviously direct contributors (such as emissions from road transport) as opposed to what are perhaps less visual and less obviously direct contributors (such as gas and electricity use[73]) and with impacts that are distant in time and space (see also Lorenzoni and Pidgeon 2006). But this can lead to misunderstanding. Climate change is a topic that tends to be incorrectly conflated with other environmental issues by the public (e.g. Upham et al. 2009), in particular general 'pollution'. In addition, while distant impacts (e.g. end-of-century projections and Arctic sea-ice melt) are often highlighted in climate science news reports, the absence of an immediate direct relevance of such phenomena can lead to the public's attenuation of the perceived risks, something termed 'psychological distancing' (Spence et al. 2011, 2012). **The results suggest that communications strategies should perhaps be developed to help the public make the link to all the important contributors and, where possible, personally relevant impacts of climate change** (see the discussion of 'cognitive representations' below).

When considering how to communicate climate science effectively, a review of the relevant literature indicates that it is important to consider the cultural factors that influence the way in which the public assimilate and process that information. It has been suggested that a number of factors should be taken into account to increase the likelihood of information being considered open-mindedly by different sections of the public (Kahan et al. 2011a):

**(i) present information in a context that recognises people's cultural values;**

**(ii) use experts with a diversity of cultural identities to communicate information; and**

**(iii) craft messages for target audiences that use familiar idioms and narratives.**

[73] *Other UK opinion polls have found a drop in the percentage of people who say it is definitely true that 'every time we use coal or gas or oil we contribute to climate change' from 35% in 2000 to 20% in 2010 (Taylor 2011).*

An important point to note is that more information is unlikely to engage the most sceptical groups, since information will tend to be interpreted in relation to existing views and entrenched views are very hard to change (Whitmarsh 2011). One of the challenges highlighted in our study is that **scientists are often viewed by the public as being poor communicators and difficult to relate to. This could perhaps be partly ameliorated by encouraging a diverse range of talented science communicators from different backgrounds**, taking account of the advice of Kahan et al. (2011a). Equally, it was evident from the focus groups that familiarity with particular 'celebrity' scientists was important for many as it allowed them to build trust over time.

When communicating through the news media there are some particular challenges. The very nature of the news format, with an emphasis on catastrophes or otherwise dramatic stories, is not particularly well-suited to describing the gradual changes of the climate itself or the incremental evolution of the body of climate science evidence, with the multiple complexities of both (Revkin 2007). In addition to this, the nuances of scientific consensus provide challenges for media outlets who strive to display 'balance' in their reporting and at the same time thrive on controversy. **There is a clear mismatch between public opinion about the level of agreement among scientists on the human causes of climate change and the reality** (our survey indicated only 60% of the UK public believe there is agreement and recent polls in the US indicate an even lower percentage[74] whereas various recent studies indicate broad agreement among more than 95% of climate scientists[75]). It has been suggested (Jones 2011) that this divergence between the views of the public and those of professionals might indicate a failure by the media to appropriately balance views of different credibility, i.e. that the media's norm of balance may give a false impression of the state of consensus among scientists.

**However, the relationship between climate science, the public and the news media may be more complex and nuanced than is sometimes perceived. Firstly, the media cannot be universally characterised**. A recent study (Painter 2011) found that the number of articles that included 'sceptical voices'[76] had increased over time in the print media[77], but that over 40% of such articles were opinion pieces or editorials. The much less systematic survey of the UK press that was undertaken here to provide material for the focus groups (which generally excluded opinion pieces) indicated that, from March 2010 to February 2011[78], it was unusual to find media articles in the UK that strayed too far from the consensus view. However, it was found that some newspapers, e.g. the Daily Express, presented a larger than average proportion of dissenting articles[79]. Other studies[80] have found that individual newspapers in the UK repeatedly use the same discourse concerning climate change[81].

**Secondly, psychological aspects inevitably influence the way climate science in the media is perceived by a scientist (Besley and Nisbet 2011)**. This can lead to scientists being unduly critical[82] or fearful[83] of the media. In addition, they may inflate their own community's communications capabilities, which in reality may be limited by the difficulties encountered by attempting to communicate with sections of the public who do not necessarily share their values and worldviews[84].

**Thirdly, careful attention needs to be paid to the full path from science to press release to media**. Studies have shown that a press release and associated activities that a scientific institution uses to publicise their reports can have a perceptible influence on how the issues are debated by the media and can allow the media to frame stories around themes that were never really intended by the scientists (Spiegelhalter and Riesch 2011a).

---

[74] *See, for example, Leiserowitz et al. (2011). In response to 'which comes closer to your view?: most scientists think global warming is happening/most scientists think global warming is not happening/there is a lot of disagreement among scientists about whether or not global warming is happening/don't know enough to say', the percentage of Americans who responded that most scientists think global warming is happening was 39% in May 2011 (34% in January 2010 and 47% in November 2008).*

[75] *See, for example: Doron and Kendall Zimmerman (2009); Anderegg et al. (2010); Farnsworth and Lichter (2011).*

[76] *These 'sceptical voices' fell broadly into the three categories of (i) those who say that global temperatures are not warming, (ii) those who say that they are warming but argue that the anthropogenic contribution to global warming or climate change is over-stated, negligible or non-existent compared to other factors like natural variations or sun spots, and (iii) those who accept it is happening but for different reasons question its impacts or the need to do something about it.*

[77] *The study looked at two 3-month periods from 2007 and 2009/10 and considered print media in six countries: Brazil, China, France, India, the UK and the US. Only Le Monde in France did not show an increase in sceptical voices.*

[78] *As noted in the study of Boykoff (2007) with respect to US media, the balance of reporting can and does shift with time; so had a different timeframe been chosen, these results may not have held true.*

[79] *Painter (2011) also found that the Daily Express stood out in terms of the coverage it gave to 'sceptical viewpoints'.*

[80] *See Doulton and Brown (2009).*

[81] *A previous study (Boykoff 2008) has noted that UK tabloid newspaper articles on climate change are predominantly framed through weather events, 'charismatic' animals and the movements of political actors and rhetoric, while few stories focus on climate justice and risk.*

[82] *Scientists may also succumb to the 'spotlight effect' whereby they exaggerate how much attention others pay to their actions (Pidgeon and Fischhoff 2011).*

[83] *In a survey for the Royal Society, when asked 'which group do you find it hardest to talk about your research', 21% of scientists said 'general journalists' (i.e. in press, TV and radio); and when asked why, 49% said it was because 'we have different agendas/they twist things', 'we don't speak the same language/they are least like me/they don't understand me' or 'they do not want to know/are least interested/don't put any effort in' (Royal Society 2006).*

[84] *See Rose (2011) for a discussion of the communication needs for individuals who hold particular values.*

**One of the key challenges in communicating climate science through the mass media is that it is inevitable that one is communicating with multiple publics at the same time, each of whom have differing needs, differing values**[85] **and differing levels of scientific literacy (Pidgeon 2010)**. The focus groups we conducted with the general public, arts/humanities academics and scientists highlighted differences in the ways these different groups engage with climate science news reports. One of the participants in the focus groups that we ran with academics said, in reference to a newspaper article, "I think if you made it more acceptable to me, you would make it less acceptable to the majority of people."

Although the central tenet of a communications strategy might be to engage the public, this should not mean that communications are diluted to the lowest common denominator. **Instead, communications could provide multiple entry and exit points to accommodate different audiences and they could be rigorously tested to ensure the information is presented in a manner that most aids understanding**[86]**. In addition, it might be helpful to expose more scientists to the complexities of opinion formation by the public**[87], since this may allow a greater mutual understanding and a more effective, deliberative model of communication (Weiler et al. 2012).

A recent study (O'Neill and Hulme 2009) that adopted a more deliberative approach compared the response of the public to climate science information framed in terms of topics suggested by experts and non-experts[88]. The public reported more interest in those topics suggested by non-experts and claimed to understand the information better. Topics to which people could personally relate or with which they had an emotional connection were found to be more engaging. **Our focus groups similarly indicated that personal relevance helps to engage the public in a topic. Other studies have shown that personal experience and intuition form an important framework through which new information is assimilated by experts and non-experts alike (e.g. Marx et al. 2007)**. Of the news reports presented in the focus groups, the one that was found to be most engaging concerned the decline in bees – this generated both a personal and an emotional connection. It should be noted, however, that while the framing of a climate science news report can be used to attract attention, it may also influence the balance of public opinions and beliefs[89] in possibly unintended ways, as discussed further below.

The report about bees, along with several other 'tabloid' news reports, was praised by all focus group participants for being clear, engaging and concise, reflecting a general appreciation for simple language and everyday examples[90]. Participants also found 'indicators of change' such as bees to be compelling because they were seen as factual and impartial. Overall, many participants wanted to be given a clearer 'cognitive representation' (or 'mental model') of the key information – for example, a simple graphical description, a simple explanation of a mechanism or a description of an indicator of change to which they could relate. The need for such cognitive representations has been noted previously by psychologists (Morgan et al. 2002), who point out that even if the representation does not provide a complete understanding, it allows people to better engage with the issue.

Discussions among the participants of our focus groups highlighted some of the aspects of climate science that are prone to misunderstanding or misinterpretation. These include: linguistic aspects (such as the example given below of the different lay use of the word 'uncertainty'[91]); methodological aspects (such as the use of computer models to provide evidence, which can be difficult to grasp even for many scientists[92]); and presentational aspects (i.e. areas of uncertainty are where much scientific research tends to lie, but areas of agreement are often of greater interest to those wanting to make decisions based on evidence from current research).

[85] *See, for example, Rose (2011).*
[86] *See, for example, Spiegelhalter et al. (2011).*
[87] *A survey in 2006 by the Royal Society found that when it came to a range of public engagement activities, the majority of scientists had not participated during the prior 12-month period (Royal Society 2006).*
[88] *In the study, the non-expert topics were the Norfolk Broads (a nature reserve located in the region where the study was conducted), London and polar bears. The expert topics were the West Antarctic Ice Sheet, ocean acidification and the thermohaline circulation.*
[89] *See, for example, Leiserowitz (2006).*
[90] *Nerlich et al. (2010), however, notes that translating science into everyday language may not be sufficient to engage the public.*
[91] *For other examples see, for example, Center for Research on Environmental Decisions (2009).*
[92] *See Pidgeon and Fischhoff (2011).*

Effectively communicating the uncertainty that is inherent in many scientific results is a particular challenge[93]. Our focus groups indicated that the word 'uncertainty' is frequently interpreted by the lay public to imply complete lack of knowledge[94] and indeed it is often used in different ways in different academic disciplines (Spiegelhalter and Riesch 2011b). **An alternative approach, which may help alleviate some of the problems, is to re-phrase scientific uncertainty statements using the everyday language of risk[95]**. This may be a more culturally congenial description (Pidgeon and Fischhoff 2011), although it would still be challenging to accurately convey the magnitude and scope of the risk[96].

The focus group participants tended to look for definitive statements in news reports and viewed statements using words such as 'could', 'may' and 'suggest' with suspicion. Studies have shown that these words are inconsistently interpreted (Spiegelhalter et al. 2011), as are the terms 'likely' and 'very likely' as used by the IPCC (Budescu et al. 2009). Indeed, the study of Budescu et al. (2009) indicated that the method used by the IPCC tends to convey levels of imprecision that are too high, which may in part explain why the UK public tends to underestimate the level of scientific agreement. **Evidence-based recommendations for improving the communication of risk/uncertainty can be found in the extensive literature on the subject and in an increasing body of work that specifically considers the communication of uncertainty in climate science** (see e.g. Budescu et al. 2009; Center for Research on Environmental Decisions 2009; Morgan et al. 2009).

**The framing of an uncertainty statement can alter its interpretation and thus needs careful consideration; the implications of this for climate science communication are complex and subtle**. It was interesting to note that some of the participants of our focus groups seemed to be happier to accept a statement of uncertainty if it was combined with an emotional statement, as in 'scientists fear it may be due to climate change'. This is an example where further testing and evaluation would be necessary to determine how such a statement is understood and then used by the public. For instance, Whitmarsh (2011) has argued that alarmist or fear-based communication is likely to undermine efforts to engage the public with climate change and that it can induce apathy or paralysis if not presented with an action strategy to reduce the perceived risk[97]. Furthermore, recent studies have indicated that positive and negative frames placed on uncertain climate science information[98] can have different influences on the willingness of people to change their behaviour in response (Spence and Pidgeon 2010; Morton et al. 2011). **We suggest that this underlines the need for scientists and science communicators to understand the implications of the ways in which they choose to phrase their results.**

* * * * *

This report has investigated current public opinion about climate change and the response of the public to the presentation of climate science in the news media. The findings of the study and of many others, some of which are reviewed here, have demonstrated that the processes used by the public to assimilate new information are complex and multifaceted. This means that climate science communications need careful design.

The report represents a first step towards adopting a more rigorous approach to climate science communication that incorporates testing and evaluation of what works and what does not work in terms of public engagement. Moreover, the focus groups conducted for this study have highlighted the value of involving the public in shaping communications strategies. The findings have provided evidence in support of a broader approach to climate science communication that is less didactic and more engaged with the public.

[93] *This uncertainty may be classified as 'aleatory' (i.e. unavoidable unpredictability or chance) or 'epistemic' (i.e. uncertainty due to things that in principle could be known but which are not known in practice). Note that many other categorisations and hierarchies of uncertainty also exist, with different academic disciplines sometimes using descriptor terms in different ways (Spiegelhalter and Riesch 2011b).*

[94] *Other studies have found similar results (Somerville and Hassol 2011).*

[95] *Here we are using the word 'risk' in its colloquial sense, rather than in Knight's strict sense (Knight 1921; Stirling 2010). It should be noted that the terms 'risk' and 'uncertainty' are often used to mean different things in different academic disciplines and in both cases the professional use of these terms may be different from the colloquial use.*

[96] *In particular, the perception of risk is itself culturally diverse; for example, different people will consider different metrics, thresholds and attributes of the risk to be relevant (Pidgeon and Fischhoff 2011). This means that the way the risk is chosen to be presented will influence the way in which different members of the public will interpret the information and assimilate it into their attitudes and beliefs.*

[97] *See also Hulme (2007) and Corner et al. (2010).*

[98] *An example of a negative frame used in the study is: 'It is 80% likely that global warming of 2°C will cause abrupt and severe changes to regional weather patterns such as monsoons and El Niño.' The corresponding positive frame is: 'It is 20% likely that global warming of 2°C will not cause abrupt and severe changes to regional weather patterns such as monsoons and El Niño.'*

# Summary of Conclusions

We repeat below the conclusions from each section of this report.

## 1. Public attitudes to climate change and climate science

### 1.1 Acceptance of, and concern about, climate change

The majority of the sample in our UK survey accepted that the world's climate is changing. However, over the past five years, levels of concern among the public and expressed willingness to change behaviour in order to limit climate change have both decreased. In addition, almost half of the public believed that the seriousness of climate change has been exaggerated.

### 1.2 Attitudes to climate science and scientists

About one-third of the public trust climate scientists to tell the truth about climate change and about one-third do not trust them. Just over half the public trust independent scientists to give an accurate portrayal of climate change. However, trust in all authority groups to give an accurate portrayal of climate change has seen a significant drop in 2011. Under two-thirds think scientists agree that humans are causing climate change. Measures of public interest, engagement and trust associated with climate science are positively correlated with concern about climate change and willingness to change behaviour.

## 2. Engaging the public in climate science

### 2.1 Reactions to climate science

Scientists were often viewed by focus group participants as being poor communicators and difficult to relate to. Aspects of a climate science news report (other than strict 'scientific' content) that influenced participants' trust in a message included whether or not: a) the messenger (both scientist and media outlet) could be perceived to have an 'agenda'; b) there appeared to be a scientific consensus; and c) the worldview of the participant was aligned with the report.

### 2.2 Interest in, and knowledge about, climate change

Interest in, and knowledge about, climate change is moderate with less than half the population saying that they like to read and think about it and less than half saying that they know a fair amount. Climate change tends to be conflated with other environmental issues. Few people spontaneously associate the causes of climate change with everyday gas and electricity use. In terms of consequences, people most readily associate climate change with impacts that are distant in time and space.

### 2.3 Interest in climate change news reports

Television was the source of climate science news most cited by focus group participants. Television documentaries can provide critical background information to later engage people in news reports. Features of a news report that make it more interesting to people include: a) relevance (stories related to UK future projections, to UK extreme weather and to UK wildlife were preferred); b) a strong narrative; c) 'new' information, including a new angle on established information; d) positive stories; e) non-alarmist but passionate delivery of the information; and f) the inclusion of information concerning how people might use the scientific results.

## 3. Communicating to the public about climate change

### 3.1 Clarity of content

Focus group participants wanted more simple diagrams or graphs to explain stories, they appreciated simple language and everyday examples, where numbers were included they wanted them put in context, and simple explanations of mechanisms that could be easily understood helped to build trust in a story. They also found 'indicators of change' compelling because these were seen as factual and impartial. 'Tabloid' articles were popular even among those who said they would not normally read them.

### 3.2 Construct of communications

It is challenging to communicate effectively the uncertainty that is inherent in many scientific results. The word 'uncertainty' is frequently misinterpreted by lay audiences as implying ignorance. Focus group participants were looking for definitive statements and were very sensitive to the use of words such as 'could', 'may' and 'suggest'. Many found the inclusion of multiple viewpoints in a news report confusing. Reports that contained a strong narrative with a clear conclusion were preferred.

### 3.3 Key criteria for news reports

Focus group participants found news reports to be most engaging when they had a 'storybook' structure including certain key elements. Popular news reports had an obvious relevance to the audience and peripheral aspects, such as the headline, the source and any associated images, were important for attracting attention. Participants liked new information to be highlighted and differing points of view to be introduced with care so as to maintain a simple flow. The language and style of reports were sometimes alienating. Finally, they wanted a summary of the key points and a clear take-home message.

## 4. Comparison of attitudes to climate change and climate science among academics and the public

### 4.1 Attitudes of academics to climate science and their reactions to climate change news reports

The academic groups, like the general public, engaged with climate science through aspects that were relevant to their own lives. Both academic groups disliked gratuitous human interest aspects of news reports, felt many reports lacked necessary detail and logical lines of argument, criticised the media for 'false balance' in reporting and recognised the challenges of communicating science (in particular scientific uncertainty), but felt the media was partly to blame for the failings. There were differences between the two academic groups, e.g. the arts/humanities group felt that they did not have the expertise to judge the veracity of climate science information but placed trust in respected institutions, whereas the science group were inherently sceptical of information, whatever the source.

### 4.2 Priorities of the different sample groups

The focus groups with the general public and the academics highlighted that, although there are similarities between the groups, there are also differences in terms of their priorities with regard to a climate science news report. The highest priority for scientists was facts and evidence, while academics in the arts/humanities were looking for a structured argument, and those in the 'lay' public saw something newsworthy as the top priority.

# References


**Anderegg, W. R. L., J. W. Prall, et al. (2010).** *"Expert credibility in climate change." Proceedings of the National Academy of Sciences of the United States of America 107(27): 12107-12109.*

**BBC/Populus. (2010).** *"BBC Climate Change Poll - February 2010." Retrieved 29th May 2011, from http://news.bbc.co.uk/nol/shared/bsp/hi/pdfs/05_02_10climatechange.pdf*

**Besley, J. C. and M. C. Nisbet (2011).** *"How scientists view the public, the media and the political process." Public Understanding of Science.*

**Blunden, J., D. S. Arndt, et al. (2011).** *"State of the climate in 2010." Bull. Amer. Meteor. Soc. 92(6): S1-S266.*

**Boykoff, M. T. (2008).** *"The cultural politics of climate change discourse in UK tabloids." Political Geography 27(5): 549-569.*

**Boykoff, M. T. and J. Smith (2010).** *"Media presentations of climate change". Routledge Handbook of Climate Change and Society. C. Lever-Tracy. Abingdon, Routledge: 210-218.*

**Brechin, S. R. and M. Bhandari (2011).** *"Perceptions of climate change worldwide." Wiley Interdisciplinary Reviews - Climate Change 2(6): 871-885.*

**Brulle, R. J., J. Carmichael, et al. (2012).** *"Shifting public opinion on climate change: an empirical assessment of factors influencing concern over climate change in the U.S., 2002-2010." Climatic Change.*

**Budescu, D. V., S. Broomell, et al. (2009).** *"Improving communication of uncertainty in the reports of the Intergovernmental Panel on Climate Change." Psychological Science 20(3): 299-308.*

**Center for Research on Environmental Decisions (2009).** *"The psychology of climate change communication: a guide for scientists, journalists, educators, political aides and interested public." From http://guide.cred.columbia.edu/pdfs/CREDguide_full-res.pdf*

**Committee on Climate Change (2008).** *"Building a low-carbon economy - the UK's contribution to tackling climate change."*

**Committee on Climate Change (2010).** *"Fourth Carbon Budget." Retrieved 12th December 2011, from http://www.theccc.org.uk/reports/fourth-carbon-budget*

**Corner, A., T. Crompton, et al. (2010).** *"Communicating climate change to mass public audiences." Retrieved 12th December 2011, from http://psych.cf.ac.uk/understandingrisk/docs/cccag.pdf*

**Demski, C. (2011).** *"Public perceptions of renewable energy technologies: challenging the notion of widespread support." PhD thesis, Cardiff University.*

**Department for Environment, Food and Rural Affairs (2007).** *"Attitudes and behaviour in relation to the environment." Retrieved 12th December 2011, from http://www.defra.gov.uk/statistics/files/pas2007 report.pdf*

**Department for Environment, Food and Rural Affairs (2011).** *"Attitudes and knowledge relating to biodiversity and the natural environment, 2007-2011." Retrieved 12th December 2011, from http://www.defra.gov.uk/statistics/files/Statistical-Release-13-April-2011-biodiversity1.pdf*

**Department for Transport (2010).** *"Public attitudes towards climate change and the impact of transport: 2006, 2007, 2008 and 2009." Retrieved 12th December 2011, from http://www2.dft.gov.uk/pgr/statistics/datatablespublications/trsnstatsatt/climatechgejan2010report.html*

**Department for Transport (2011).** *"Public attitudes towards climate change and the impact of transport: 2010." Retrieved 12th December 2011, from http://www.dft.gov.uk/statistics/releases/attitudes-to-climate-change-and-its-impact-on-transport-august-2010*

**Department for Transport (2012).** *"Public attitudes towards climate change and the impact of transport in 2011." Retrieved 2nd February 2012, from http://www.dft.gov.uk/statistics/releases/climate-change-and-impact-of-transport-2011*

**Doron, P. and M. Kendall Zimmerman (2009).** *"Examining the scientific consensus on climate change." EOS 90(3): 22-23.*

**Doulton, H. and K. Brown (2009).** *"Ten years to prevent catastrophe? Discourses of climate change and international development in the UK press." Global Environmental Change 19: 191-202.*

**Farnsworth, S. J. and S. R. Lichter (2011).** *"The structure of scientific opinion on climate change." Int J Public Opin Res.*

**Hassol, S. J. (2008).** *"Improving how scientists communicate about climate change." EOS 89: 106-107.*

**Hulme, M. (2007).** *"Newspaper scare headlines can be counter-productive." Nature 445: 818.*

**Hulme, M. (2009).** *"Why we disagree about climate change: understanding controversy, inaction and opportunity." Cambridge, New York; Cambridge University Press.*

**InterAcademy Council (2010).** *"Climate change assessments, review of the processes and procedures of the IPCC." Retrieved 12th December 2011, from http://reviewipcc.interacademycouncil.net/report.html*

**IPCC (2007).** *"Fourth Assessment Report." IPCC*.

**Ipsos MORI (2011).** *"Trust in professions 2011."*

**Jones, S. (2011).** *"A review of the impartiality and accuracy of the BBC's coverage of science." Retrieved 12th December 2011, from http://www.bbc.co.uk/bbctrust/assets/files/pdf/our_work/science_impartiality/science_impartiality.pdf*

**Kahan, D. M., H. Jenkins-Smith, et al. (2011a).** *"Cultural cognition of scientific consensus." Journal of Risk Research 14(2): 147-174.*

**Kahan, D. M., M. Wittlin, et al. (2011b).** *"The tragedy of the risk-perception commons: culture conflict, rationality conflict, and climate change." Cultural Cognition Project. Working Paper No. 89. from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1871503*

**Knight, F. (1921).** *Risk, Uncertainty and Profit. Houghton Mifflin.*

**Leiserowitz, A. (2006).** *"Climate change risk perception and policy preferences: the role of affect, imagery, and values." Clim Change 77: 45-77.*

**Leiserowitz, A., E. Maibach, et al. (2011).** *"Climate change in the American mind: Americans' global warming beliefs and attitudes in May 2011." From http://environment.yale.edu/climate/files/ClimateBeliefsMay2011.pdf*

**Lorenzoni, I. and N. Pidgeon (2006).** *"Public views on climate change: European and USA perspectives." Climatic Change 77: 73-95.*

**Marx, S. M., E. U. Weber, et al. (2007).** *"Communication and mental processes: experiential and analytic processing of uncertain climate information." Global Environmental Change - Human and Policy Dimensions 17(1): 47-58.*

**Morgan, G., H. Dowlatabadi, et al. (2009).** *"Best practice approaches for characterizing, communicating and incorporating scientific uncertainty in climate decision making." National Oceanic and Atmospheric Administration. From http://www.climatescience.gov/Library/sap/sap5-2/final-report/default.htm*

**Morgan, M. G., B. Fischhoff, et al. (2002).** *Risk Communication: A Mental Models Approach, Cambridge University Press.*

**Morton, T. A., A. Rabinovich, et al. (2011).** *"The future that may (or may not) come: how framing changes responses to uncertainty in climate change communications." Global Environmental Change 21: 103-109.*

**Moser, S. C. (2010).** *"Communicating climate change: history, challenges, process and future directions." Wiley Interdisciplinary Reviews - Climate Change 1(1): 31-53.*

**Nerlich, B., N. Koteyko, et al. (2010).** *"Theory and language of climate change communication." Wiley Interdisciplinary Reviews - Climate Change 1(1): 97-110.*

**O'Neill, S. J. and M. Hulme (2009).** *"An iconic approach for representing climate change." Global Environmental Change - Human and Policy Dimensions 19(4): 402-410.*

**Painter, J. (2011).** *Poles Apart - The International Reporting of Climate Scepticism. Oxford, Reuters Institute for the Study of Journalism, University of Oxford.*

**Pidgeon, N. (2010).** *"Public understanding of and attitudes towards climate change." In Foresight report: International Dimensions of Climate Change. Retrieved 12th December 2011, from http://www.bis.gov.uk/assets/bispartners/foresight/docs/international-dimensions/11-1021-public-understanding-of-climate-change.pdf*

**Pidgeon, N. and B. Fischhoff (2011).** *"The role of social and decision sciences in communicating uncertain climate risks." Nature Climate Change 1(1): 35-41.*

**Poortinga, W., N. F. Pidgeon, et al. (2006).** *"Public perceptions of nuclear power, climate change and energy options in Britain: summary findings of a survey conducted during October and November 2005." In Technical Report (Understanding Risk Working Paper 06-02), Norwich: Centre for Environmental Risk.*

**Poortinga, W., A. Spence, et al. (2011).** *"Uncertain climate: an investigation into public scepticism about anthropogenic climate change." Global Environmental Change - Human and Policy Dimensions 21(3): 1015-1024.*

**Revkin, A. (2007).** *"Climate change as news: challenges in communicating environmental science." Climate Change: What It Means fo U.S., Our Children, and Our Grandchildren. P. M. Doughman and J. C. Dimention. Boston, Mass., MIT Press.*

**Rose, C. (2011).** *"What makes people tick - the three hidden worlds of settlers, prospectors and pioneers." Leicester, Matador.*

**Royal Society (2006).** *"Factors affecting science communication." Retrieved 12th December 2011, from http://royalsociety.org/Content.aspx?id=5232*

**Russell, M. (2010).** *"The independent climate change e-mails review." Retrieved 12th December 2011, from http://www.cce-review.org/*

**Somerville, R. C. J. and S. J. Hassol (2011).** *"Communicating the science of climate change." Physics Today 64(10): 48-53.*

**Spence, A. and N. Pidgeon (2010).** *"Framing and communicating climate change: the effects of distance and outcome frame manipulations." Global Environmental Change 20(4): 656-667.*

**Spence, A., W. Poortinga, et al. (2011).** *"Perceptions of climate change and willingness to save energy related to flood experience." Nature Climate Change 1(1): 46-49.*

**Spence, A., W. Poortinga, et al. (2012).** *"The pyschological distance of climate change." Risk Analysis 32(6): 957-972.*

**Spence, A., D. Venables, et al. (2010).** *"Public perceptions of climate change and energy futures in Britain: summary findings of a survey conducted in January-March 2010." In Technical Report (Understanding Risk Working Paper 10-01) Cardiff: School of Psychology.*

**Spiegelhalter, D., M. Pearson, et al. (2011).** *"Visualizing uncertainty about the future." Science 333(6048): 1393-1400.*

**Spiegelhalter, D. and H. Riesch (2011a).** *"'Careless pork costs lives': Risk stories from science to press release to media." Health, Risk and Society 13: 47-64.*

**Spiegelhalter, D. and H. Riesch (2011b).** *"Don't know, can't know: embracing deeper uncertainties when analysis risks." Phil. Trans. R. Soc. A 369: 4730-4750.*

**Stirling, A. (2010).** *"Keep it complex." Nature 468: 1029-1031.*

**Taylor, E. (2011).** *"Environment." In British Social Attitudes 28, Editor, A. Park, NatCen Social Research. Retrieved 12th December 2011, from http://www.natcen.ac.uk/study/british-social-attitudes-28th-report*

**Times/Populus (2009).** *"Times Poll - November 6th-8th 2009." Retrieved 12th December 2011, from http://www.populus.co.uk/uploads/download_pdf-081109-The-Times-The-Times-Poll---November-2009.pdf*

**Upham, P., L. Whitmarsh, et al. (2009).** *"Public attitudes to environmental change: a selective review of theory and practice." Editor, L. w. E. Change. Retrieved 12th December 2011, from http://www.lwec.org.uk/sites/default/files/Public attitudes to environmental change_executive summary_301009_2.pdf*

**Weber, E. U. (2010).** *"What shapes perceptions of climate change?" Wiley Interdisciplinary Reviews - Climate Change 1(3): 332-342.*

**Weiler, C. S., J. K. Keller, et al. (2012).** *"Personality type differences between PhD climate researchers and the general public: implications for effective communication." Climatic Change 112(2): 233-242.*

**Whitmarsh, L. (2011).** *"Scepticism and uncertainty about climate change: dimensions, determinants and change over time." Global Environmental Change - Human and Policy Dimensions 21(2): 690-700.*

**Wolf, J. and S. C. Moser (2011).** *"Individual understandings, perceptions, and engagement with climate change: insights from in-depth studies across the world." Wiley Interdisciplinary Reviews - Climate Change 2(4): 547-569.*

**World Bank (2010).** *"Public attitudes toward climate change: findings from a multi-country poll." In World Development Report 2010: Development and Climate Change. Retrieved 12th December 2011, from http://go.worldbank.org/G3179IRB20*

# Appendix: Topline Results – Climate Science Survey 2011

- Results are based on 1007 face-to-face, in-home computer-assisted personal interviews with members of the British public (England, Scotland, Wales and Northern Ireland) aged 16+.
- Fieldwork was conducted between 17th and 22nd March 2011, with Q9 re-run between 12th and 17th May 2011 (with 1013 members of the public) to gather more information concerning what people think the consequences of climate change are by detailing the responses categorised as 'something else'.
- Data are weighted to match the demographic profile of the UK as a whole.
- Where results do not sum to 100, this may be due to multiple responses or rounding.
- Results are based on all respondents unless otherwise stated.
- An asterisk (*) represents a value of less than one per cent, but more than zero.
- Where possible, comparative data have been provided from similar surveys, mainly conducted between 2005 and 2011.

## A note on the polling statistics:

Throughout this report, we compare our results to those found in previous polls. When we refer to a 'statistically significant' change, we mean that the 95% confidence intervals for the proportion of people who gave a particular response in year A and year B do not overlap. The 95% confidence intervals are calculated by assuming a binomial distribution. For example, one of the first statistics we give in this report relates to people's opinions about the causes of climate change (Q3). We can divide the respondents into two groups: those who believe climate change is 'entirely' or 'mainly' due to natural causes (20% of respondents) and everyone else (80%). Thus the probability of a respondent being in the 'entirely or mainly natural' group is $p = 0.2$. Our sample size is $n = 1007$. We calculate confidence intervals as follows:

standard deviation of a binomial distribution = $s = \sqrt{(p\ (1-p))} = 0.4$

standard error = $\sigma = s/\sqrt{n} = 0.0126$

95% confidence interval = $\pm 1.96\ \sigma = \pm 0.0247$

Thus the upper and lower 95% confidence intervals for the proportion of people in the combined 'entirely or mainly natural' group lie at 20±2%. We can similarly calculate the confidence intervals when the same question was asked in the Met Office/EA/Ipsos MORI 2009 poll, where only 9% of respondents were in the 'entirely or mainly natural' group and the sample size was $n = 998$. In that case, the 95% confidence interval calculation gives 9±2% and the increase from 9% in 2009 to 20% in 2011 can be considered statistically significant by this measure, as the intervals do not overlap.

### Q1. How concerned, if at all, are you about climate change, sometimes referred to as "global warming"?

| | 2011 % | DfT 2011 % | DfT 2010 % | Cardiff/ Ipsos MORI 2010 % | DfT 2009 % | Ipsos MORI 2008 % | UEA/MORI 2005 % |
|---|---|---|---|---|---|---|---|
| Very concerned | 22 | 18 | 21 | 28 | 24 | 30 | 44 |
| Fairly concerned | 41 | 46 | 50 | 43 | 52 | 47 | 38 |
| Not very concerned | 22 | 25 | 22 | 19 | 19 | 14 | 12 |
| Not at all concerned | 13 | 8 | 6 | 8 | 4 | 9 | 3 |
| Don't know | 1 | 1 | 1 | 1 | - | - | - |
| No opinion | * | - | - | 1 | - | - | 1 |

In the DfT surveys, the question asked was: 'how concerned are you about climate change?' The option 'no opinion' was not given and the additional option 'I don't believe climate change is happening' was given, with 1% of respondents choosing this in both 2009 and 2010, and 2% in 2011. The DfT surveys in 2006/07/08 also included this question. In the UEA/MORI 2005 survey, the 'don't know' and 'no opinion' categories were combined when reported.

### Q2. As far as you know, do you personally think the world's climate is changing or not?

| | 2011 % | Cardiff/Ipsos MORI 2010 % | BBC/Populus 2010 % | Times/Populus 2009 % | UEA/MORI 2005 % |
|---|---|---|---|---|---|
| Yes | 80 | 78 | 75 | 83 | 91 |
| No | 13 | 15 | 25 | 15 | 4 |
| Don't know | 7 | 6 | - | 2 | 5 |

In the Times/Populus 2009 survey and the BBC/Populus 2010 survey, the question asked was: 'from what you know and have heard, do you think that the Earth's climate is changing and global warming taking place?' The option 'don't know' was not reported in the BBC/Populus survey.

### Q3. Thinking of the causes of climate change, which best describes your opinion?

| | 2011 % | Cardiff/ Ipsos MORI 2010 % | Met Office/ EA/Ipsos MORI 2009 % | Ipsos MORI 2006 % | MORI 2002 % |
|---|---|---|---|---|---|
| Climate change is entirely caused by natural processes | 8 | 6 | - | - | - |
| Climate change is mainly caused by natural processes | 12 | 12 | 9 | 9 | 9 |
| Climate change is partly caused by natural processes and partly caused by human activity | 46 | 47 | 45 | 41 | 41 |
| Climate change is mainly caused by human activity | 22 | 24 | 34 | 46 | 44 |
| Climate change is entirely caused by human activity | 6 | 7 | - | - | - |
| I think there is no such thing as climate change | 2 | 2 | 3 | 1 | 3 |
| Don't know | 3 | 2 | 8 | 3 | 3 |
| No opinion | * | 1 | - | - | - |

In the Met Office/EA/Ipsos MORI 2009 and the Ipsos MORI 2002 & 2006 surveys, the options 'climate change is entirely caused by natural processes', 'climate change is entirely caused by human activity' and 'no opinion' were not given.

### Q4. To what extent do you agree or disagree with each of the following statements about climate change?

#### a. The seriousness of climate change is exaggerated

| | 2011 % | Cardiff/Ipsos MORI 2010 % | Eurobarometer 2009b % | Eurobarometer 2009a % | Eurobarometer 2008 % |
|---|---|---|---|---|---|
| Strongly agree | 12 | 12 | 10 | 12 | 10 |
| Tend to agree | 32 | 28 | 29 | 28 | 29 |
| Neither agree nor disagree | 17 | 15 | - | - | - |
| Tend to disagree | 20 | 28 | 33 | 30 | 30 |
| Strongly disagree | 15 | 14 | 21 | 24 | 22 |
| Don't know | 3 | 2 | 7 | 6 | 9 |
| No opinion | * | 1 | - | - | - |

In the Eurobarometer surveys, the options 'neither agree nor disagree' and 'no opinion' were not given.

#### b. Most scientists agree that humans are causing climate change

| | 2011 % | Cardiff/Ipsos MORI 2010 % |
|---|---|---|
| Strongly agree | 18 | 14 |
| Tend to agree | 42 | 42 |
| Neither agree nor disagree | 18 | 17 |
| Tend to disagree | 13 | 16 |
| Strongly disagree | 5 | 4 |
| Don't know | 3 | 1 |
| No opinion | * | 4 |

### Q5. How much would you say you know about climate change?

| | 2011 % | Defra 2011 % | DfT 2009 % | Defra 2009 % | Defra 2007 % | DfT 2006 % |
|---|---|---|---|---|---|---|
| A lot | 5 | 11 | 11 | 14 | 16 | 9 |
| A fair amount | 36 | 33 | 43 | 47 | 45 | 43 |
| A little | 42 | 44 | 34 | 33 | 32 | 34 |
| Hardly anything | 12 | - | 8 | - | - | 8 |
| Nothing, but I've heard about it | 5 | 8 | 3 | 4 | 5 | 5 |
| I hadn't heard about it before now | * | 2 | 0 | 1 | 1 | 1 |

The DfT surveys in 2007/08 also included this question, but the DfT 2011 survey did not. In the Defra surveys, the question asked was: 'how much if anything would you say you know about the following terms?: climate change'. The option 'just a little' was given instead of 'a little' and the option 'hardly anything' was not given.

**Q6. To what extent do you agree or disagree with the following statement?**

**We can trust climate scientists to tell us the truth about climate change**

| | 2011 % | Cardiff/Maximiles 2010 % |
|---|---|---|
| Strongly agree | 6 | 4 |
| Tend to agree | 32 | 20 |
| Neither agree nor disagree | 25 | 43 |
| Tend to disagree | 21 | 25 |
| Strongly disagree | 13 | 8 |
| Don't know | 3 | - |
| No opinion | * | - |

For the Cardiff/Maximiles 2010 survey the overall the sample (size 499) was a relatively good representation of the UK population, with slightly less respondents over the age of 75. This sample was also slightly more educated than a nationally representative sample. It was especially higher in respondents with degree-level education and lower in respondents with no formal qualifications.

**Q7. Which of the following groups, if any, do you trust to give you correct information on climate change? (Respondents could choose more than one answer)**

| | 2011 % | DfT 2009 % | DfT 2008 % | DfT 2007 % | DfT 2006 % |
|---|---|---|---|---|---|
| The government | 10 | 15 | 14 | 17 | 14 |
| Business and industry | 4 | 5 | 5 | 6 | 4 |
| Environmental groups | 32 | 37 | 40 | 42 | 46 |
| Government scientists | 13 | 20 | 17 | 21 | 21 |
| Independent scientists (e.g. University Research Centres) | 51 | 61 | 65 | 62 | 68 |
| The media | 9 | 9 | 10 | 13 | 13 |
| Other | 2 | 1 | 1 | 1 | 1 |
| None of these | 18 | 12 | 13 | 11 | 6 |

The DfT 2011 survey did not include this question.

### Q8. What type of things do you think contribute towards climate change? (Unprompted in our survey and the DfT surveys)

| | 2011 % | DfT 2011 % | DfT 2010 % | DfT 2009 % | DfT 2006 % | Defra 2001 % | Defra 1996/7 % | Defra 1993 % |
|---|---|---|---|---|---|---|---|---|
| Destruction of forests/cutting down trees | 27 | 22 | 22 | 25 | 28 | 74 | 56 | 52 |
| Emissions from road transport | 47 | 55 | 59 | 65 | 72 | 66 | 42 | 41 |
| Emissions from planes | 26 | 31 | 36 | 37 | 40 | - | - | - |
| Emissions from power stations | 26 | 30 | 30 | 32 | 35 | 56 | 45 | 49 |
| Other CO2 emissions | 26 | 30 | 31 | 30 | 30 | 71 | 53 | 62 |
| Burning fossil fuels for energy | 26 | 26 | 25 | 29 | 30 | - | - | - |
| Aerosols/CFCs | 12 | 13 | 13 | 13 | 21 | - | - | - |
| Use of electricity/gas at home | 15 | 13 | 16 | 15 | 14 | 20 | 12 | 16 |
| Use of electricity/gas by businesses | 13 | 13 | 16 | 16 | 19 | 28 | 19 | 22 |
| Natural causes | 24 | 16 | 15 | 11 | 10 | 1 | - | - |
| Other | 21 | 17 | 13 | 22 | 13 | - | - | - |
| None | * | 1 | - | 1 | 1 | - | - | - |
| Don't know | 7 | 10 | 9 | 6 | 7 | - | - | - |
| I don't believe in climate change | 2 | 5 | 5 | 1 | 1 | - | - | - |

The DfT surveys in 2007/08 also included this question. In the Defra surveys the question asked was: 'which, if any, of the things listed on this card do you think are major contributors to climate change?' Several of the options (denoted by -) were not given.

### Q9. What do you think are the consequences of climate change? (Unprompted)

| | 12-17 May 2011 % | 17-22 Mar 2011 % | DfT 2009 % | DfT 2006 % |
|---|---|---|---|---|
| Changing global climate | 25±3 | 30±3 | 41 | 50 |
| Melting ice caps | 18±3 | 24±3 | 28 | 31 |
| A hole in the ozone layer | 8±2 | 15±2 | 17 | 21 |
| Changing local weather | 23±3 | 22±3 | 31 | 38 |
| More extreme weather conditions | 32±3 | 36±3 | 34 | 39 |
| Increased pollution | 10±2 | 12±2 | 14 | 16 |
| Increased skin cancer | 4±1 | 6±2 | 11 | 15 |
| Impacts on habitats/wildlife | 11±2 | 13±2 | 22 | 22 |
| Impact on farming/food production | 10±2 | 10±2 | 18 | 19 |
| Rising sea levels/flooding | 26±3 | 30±3 | 30 | 39 |
| Something else | 22±3 | 19±2 | - | - |
| None/nothing | 8±2 | 6±2 | 8 | 4 |
| Don't know | 12±2 | 10±2 | 11 | 10 |

The DfT surveys in 2007/08 also included this question, but it was not asked in 2010/11. We list the confidence intervals for the 2011 surveys. In the report we have presented the results averaged across the two 2011 survey runs.

**Q10. We have some further statements regarding how you think about climate change. To what extent do you agree or disagree with each of the following statements?**

**a. I like to read and think about climate change**

| | 2011 % | Cardiff/Ipsos MORI 2010 % |
|---|---|---|
| Strongly agree | 8 | 11 |
| Tend to agree | 29 | 35 |
| Neither agree nor disagree | 21 | 19 |
| Tend to disagree | 23 | 26 |
| Strongly disagree | 16 | 9 |
| Don't know | 2 | * |
| No opinion | 1 | 1 |

**b. I would be prepared to change my behaviour to help limit climate change**

| | 2011 % | DfT 2011 % | DfT 2010 % | DfT 2009 % | DfT 2006 % |
|---|---|---|---|---|---|
| Strongly agree | 20 | 20 | 22 | 19 | 22 |
| Tend to agree | 49 | 45 | 50 | 55 | 56 |
| Neither agree nor disagree | 13 | 19 | 15 | 16 | 15 |
| Tend to disagree | 9 | 6 | 5 | 5 | 5 |
| Strongly disagree | 6 | 3 | 2 | 3 | 1 |
| Don't know | 2 | 2 | 2 | 2 | 2 |
| No opinion | * | - | - | - | - |

In the DfT 2006 & 2009 surveys, the options given were 'agree' or 'disagree' in place of 'tend to agree' and 'tend to disagree'. In all the DfT surveys, the option 'no opinion' was not given and in the 2010 & 2011 surveys the additional option 'I don't believe my behaviour can influence climate change' was given, with 5% of respondents choosing this in both years. DfT surveys in 2007/08 also included this question.

## Details of other polls listed

**BBC/Populus 2010:** *Populus interviewed a random sample of 1001 adults aged 18+ by telephone on 3rd and 4th February 2010. Interviews were conducted across the country and the results have been weighted to be representative of all adults. See http://news.bbc.co.uk/nol/shared/bsp/hi/pdfs/05_02_10climatechange.pdf*

**Cardiff/Ipsos MORI 2010:** *Results were based on 1822 face-to-face, in-home CAPI interviews with members of the British public (England, Scotland and Wales) aged 15+. Fieldwork was conducted between 6th January and 26th March 2010. Data were weighted to the profile of the known population. Details can be found at http://www.ipsos-mori.com/Assets/Docs/Polls/climate-change-still-high-on-publics-agenda-topline.pdf*

**Cardiff/Maximiles 2010:** *The sample size was 499 with online sampling by Maximiles. Data collection took place between 23rd and 15th November 2010. To ensure that respondents were recruited from a diverse socio-economic background, the survey used age and gender quotas and was distributed to panel members with differing educational backgrounds as specified by the researcher (18% no qualifications, 26% GCSEs, 25% A-Levels, 25% Bachelor's Degree or similar, 6% postgraduate/PhD). The survey was distributed to panel members from all regions in the UK. Details in Demski (2011).*

**Defra 2007:** *3618 people were interviewed in England in April and May 2007. The sample was representative of the adult population of England in terms of age, gender, social grade, government region and number of people in the household, so the data have not been weighted. Details can be found at http://www.defra.gov.uk/statistics/files/pas2007report.pdf and http://www.defra.gov.uk/statistics/files/pas2007_data_all.pdf*

**Defra 2009:** *Results were based on 2009 interviews with adults aged 16+ in England, conducted between 17th February and 25th March 2009. Details can be found at http://www.defra.gov.uk/statistics/files/report-attitudes-behaviours2009.pdf and http://www.defra.gov.uk/statistics/files/data-tables2009.pdf*

**Defra 2011:** *Results were based on 1769 face-to-face interviews in England conducted in late March 2011. Details can be found at http://www.defra.gov.uk/statistics/files/Statistical-Release-13-April-2011-biodiversity1.pdf and http://www.defra.gov.uk/statistics/files/PDF-data-tables-final.pdf*

**Defra 2001:** *Results were based on 3736 face-to-face, in-home interviews conducted between 29th January and 5th April 2001 with individuals aged 18+ across England. The data has been weighted to be representative of all adults. Details can be found at http://www.defra.gov.uk/statistics/files/pas-survey2001.pdf*

**Defra 1996/97:** *Results were based on 1782 interviews in England and Wales. Details can be found at http://www.defra.gov.uk/statistics/files/pas-summary-1997.pdf*

**DfT 2011:** *The ONS Opinions (Omnibus) Survey is a random probability survey of adults aged 16+ living in private households in Great Britain. Adults were interviewed face-to-face in their homes in August 2011. The survey resulted in a sample size of 1137. Details can be found at http://www.dft.gov.uk/statistics/releases/climate-change-and-impact-of-transport-2011*

**DfT 2010:** *The report was based on a survey module which was included in the Office for National Statistics' (ONS's) August 2010 Opinions Survey. The ONS Opinions Survey is a random probability survey of adults aged 16+ living in private households in Great Britain. Adults are interviewed face-to-face in their homes. The sample size was 1011. Details can be found at http://www.dft.gov.uk/statistics/releases/attitudes-to-climate-change-and-its-impact-on-transport-august-2010*

**DfT 2006-9:** *The reports were based on survey modules placed on the Office for National Statistics' (ONS's) Opinions/Omnibus Surveys. Survey dates were: August 2006 (sample size 1238), April 2007 (sample size 1083), August 2007 (sample size 1170), February 2008 (sample size 1095), August 2008 (sample size 1102) and August 2009 (sample size 1007). Details can be found at http://www.dft.gov.uk/statistics/releases/public-attitudes-towards-climate-change-and-the-impact-on-transport-january-2010-report*

**Eurobarometer 2008:** *1306 people were interviewed in the UK between 1st and 24th April 2008. Details can be found at http://ec.europa.eu/public_opinion/archives/ebs/ebs_300_full_en.pdf*

**Eurobarometer 2009a:** *1304 people were interviewed in the UK between 22nd January and 13th February 2009. Details can be found at http://ec.europa.eu/public_opinion/archives/ebs/ebs_313_en.pdf*

**Eurobarometer 2009b:** *1331 people were interviewed in the UK between 28th August and 15th September 2009. Details can be found at http://ec.europa.eu/public_opinion/archives/ebs/ebs_322_en.pdf*

**Ipsos MORI 2006:** *1002 British adults aged 16+ were interviewed by telephone between 25th and 27th August 2006. Reported at http://www.ipsos-mori.com/DownloadPublication/1174_sri_tipping_point_or_turning_point_climate_change.pdf*

**Ipsos MORI 2008:** *Ipsos MORI interviewed 1039 British adults aged 15+. Fieldwork was conducted face-to-face and in-home between 23th and 29th May 2008. Details can be found at http://www.ipsos-mori.com/researchpublications/ researcharchive/2305/Public-attitudes-to-climate-change-2008-concerned-but-still-unconvinced.aspx*

**Met Office/EA/Ipsos Mori 2009:** *998 face-to-face, in-home interviews were conducted with British adults aged 16+. Fieldwork was conducted by Ipsos MORI between 14th and 20th August 2009. Reported in 'Our changing environment: fight or fatigue? – dealing with a changing climate.'*

**MORI 2002:** *Reported in http://www.ipsos-mori.com/DownloadPublication/1174_sri_tipping_point_or_turning_point_ climate_change.pdf*

**Times/Populus 2009:** *Populus interviewed a random sample of 1504 adults aged 18+ by telephone between 6th and 8th November 2009. Interviews were conducted across the country and the results have been weighted to be representative of all adults. See http://www.populus.co.uk/uploads/download_pdf-081109-The-Times-The-Times-Poll---November-2009.pdf*

**UEA/MORI 2005:** *Interviews for this study were conducted between 1st October and 6th November 2005. A quantitative survey was undertaken in Great Britain (England, Scotland and Wales) by MORI. A national representative quota sample of 1491 people aged 15+ was interviewed face-to-face in their own homes. Some details can be found at http://www.ipsos-mori.com/Assets/Docs/Polls/climate-change-still-high-on-publics-agenda-topline.pdf*






Produced by Research Councils UK's internal service provider