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Conservation bulletin

Adapting to a Changing Climate

Climate change is happening. But what will it do to our historic environment? And how can our knowledge of the past help us adapt to the future?

Climate change is nothing new. Erected at a time when Cornwall's climate was starting to cool down, the Bronze Age Men Gurta longstone now stands in the shadow of the St Breock Downs windfarm, the latter a monument to a new phase of rising temperature. © English Heritage Photo Library

ENGLISH HERITAGE

Editorial: Adapting to a Changing Climate

The historic environment will have much to teach us on our journey to a more sustainable low-carbon way of life.

Damaging climate change, driven by greenhouse gas emissions, is now widely recognised as the defining issue of our time. It is the most significant environmental, social and economic challenge faced by humanity.

The UK is actively thinking about how we can adapt to the climatic changes that are now inevitable in the short term and how we can reduce emissions to avoid even more drastic changes in the future. This is influencing Government policy in many areas, including spatial planning, land use, agriculture and transport, and is increasingly affecting our personal behaviour.

The historic environment is not immune from the impacts of climate change. Shifts in temperature, sea level, storminess, flood risk and the distribution of pests and disease will inevitably take their toll on traditional buildings, historic townscapes, archaeological sites and cherished landscapes. This, in turn, could diminish the valuable contribution our heritage makes socially and economically. The measures necessary to adapt to and combat climatic instability will also necessitate significant change in the historic environment, not all of which will conform to current thinking about heritage management.

The challenge faced by our sector is considerable. We need to develop a far better picture of the nature, scale and timing of potential impacts. We need to define how change can be accommodated while the cultural significance of historic assets is conserved right across the whole spectrum of our heritage. We need to bridge the significant gap between the still uncertain predictions of climatic changes and the need for practical adaptive action on the ground. In particular we need to identify those changes that are low-risk, economic and effective and avoid those that are unnecessary, impractical or might reduce flexibility for further adaptation. Research by the historic environment sector and by others will play a fundamental role in delivering this agenda. Above all, we must remember that our historic buildings and places have always existed in a changing climate. We must not underestimate their resilience or capacity to adapt. We must not neglect the lessons we can learn from the record of past environmental change and human adaptation to it. And we must recognise that we have a wealth of information derived from ancestors who often lived more sustainably than we do today and for whom energy was not such a throw-away commodity.

If the historic environment is to play a creative role in forging a sustainable and cohesive low-carbon society we also need to understand much more about the contribution of the millions of traditional houses, factories, offices and places of worship that give our towns and villages their distinctive sense of place. To set the ball rolling, English Heritage recently invited delegates from across the spectrum of the built environment to pool their experience and begin to establish a new way forward (*Inventing the Future*, pp 20–25).

In this issue of *Conservation Bulletin* we examine work being undertaken by English Heritage and our partners to respond to the challenge of climate change. This work is still in its infancy but establishes a direction of travel that will become the dominant theme in the years ahead. We are therefore particularly pleased to announce a major partnership between English Heritage and E.ON. As organisations, we are both committed to caring for and protecting the environment for future generations and will be collaborating on a wide range of initiatives that will make a real contribution to the goal of reducing the impact of climate change upon the built environment. ■

Edward Impey
Director of Research and Standards, English Heritage

Conservation Bulletin is published three times a year by English Heritage and circulated free of charge to more than 15,000 conservation specialists, opinion-formers and decision-makers. Its purpose is to communicate new ideas and advice to everyone concerned with the understanding, management and public enjoyment of England's rich and diverse historic environment.

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Facing the Facts

Climate change is nothing new – but how is this current episode going to differ from those of the past, and what more do we need to know?

Projecting the UK's changing climate

Roger Street
Technical Director, UK Climate Impacts Programme

The climate in the UK is changing. This is particularly evident to those whose livelihoods are sensitive to the vagaries of the weather and climate, but is also reflected in the temperature and precipitation records from across the UK (Jenkins *et al* 2007):

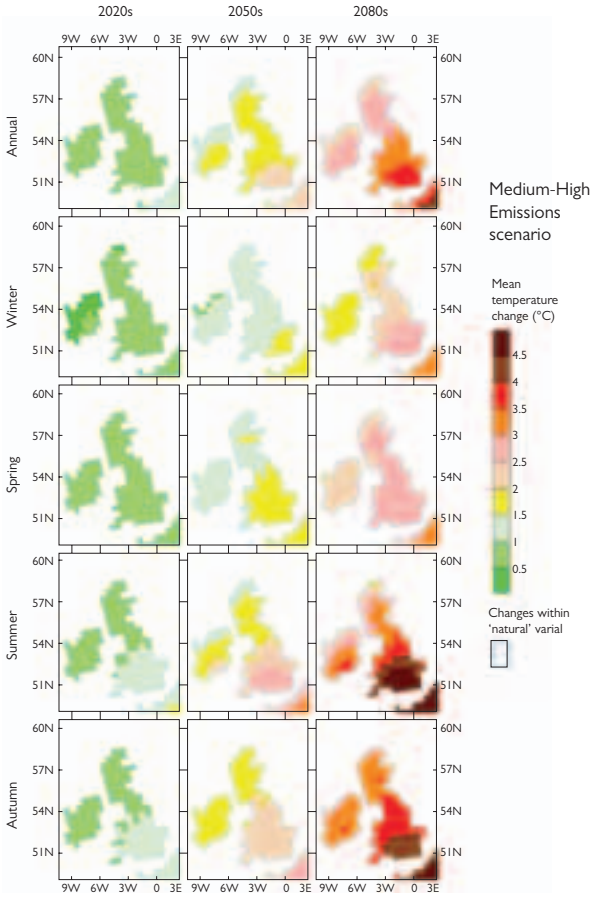
- Central England temperatures have risen by about a degree Celsius since the 1970s, with 2006 being the warmest on record. Temperatures in Scotland and Northern Ireland have risen by about 0.8°C since about 1980. The thermal growing season for plants has increased by up to 30 days since 1900.
- Annual mean precipitation over England and Wales has not changed significantly since records began in 1766. Seasonal rainfall is highly variable, but appears to have decreased in summer and increased in winter, although with little change in the latter over the last 50 years.
- All regions of the UK have experienced an increase over the past 45 years in the contribution to winter rainfall from heavy precipitation events; in summer all regions except NE England and N Scotland show decreases.
- Sea level around the UK rose by about 1mm/year in the 20th century, corrected for land movement. The rate for the 1990s and 2000s has been higher than this.

Furthermore, these changes in our climate and the associated impacts are projected to continue. This assertion is based on the conclusions of the recently released assessment report of the Intergovernmental Panel on Climate Change (IPCC AR4, 2007, **www.ipcc.ch**) and is reflected in the available climate change scenarios from the UK Climate Impacts Programme (UKCIP, **www.ukcip.org.uk**).

Over the past 10 years UKCIP and the Met Office Hadley Centre have made available climate change scenarios for the UK that are intended to help organisations identify how they might be affected by climate change and what they can do to minimise their risks or to exploit potential opportunities. The current set of these scenarios, referred to as UKCIP02, was released in 2002 and describes how the future climate of the UK is projected to evolve over the course of this century.

The UKCIP02 climate change scenarios are based on the results of a climate model (HadCM3) developed by the Met Office Hadley Centre. They reflect the best understanding, at that time, of how the climate system operates. The presentation of the information is based on four internationally recognised plausible emission futures for the 21st century. These four futures in turn are based on various assumptions about future human trends and behaviour (such as population growth, socio-economic development and technological advances), and how these might influence future global emissions of greenhouse gases and aerosols.

As such, UKCIP02 provides four alternative scenarios of climate change, ranging from that projected for a world of rapid economic growth with intensive use of fossil fuels (labelled High



Projected change in average annual, winter and summer temperature in 2020s, 2050s, and 2080s for the low and high emissions scenarios.

Emissions) to that projected for a world with increased economic, social and environmental sustainability with cleaner energy technologies (labelled Low Emissions).

UK climate projections

The headline messages from the UKCIP02 projections describe a different climate for the UK over this century.

The UK is projected to continue to get warmer

- By 2040, the average annual temperature for the UK is expected to rise by between 0.5 and 1°C, depending on region. By 2100, the average annual temperature for the UK is expected to rise by between 1 and 5°C, depending on region and emissions scenario (high confidence).
- There is expected to be greater warming in the south and east than in the north and west (high confidence).
- There is expected to be greater warming in the summer and autumn than in the winter and spring (medium confidence).
- The thermal growing season is expected to continue to lengthen (high confidence), but soil moisture levels in the summer and autumn are expected to decrease (high confidence).

Summers are projected to continue to get hotter and drier

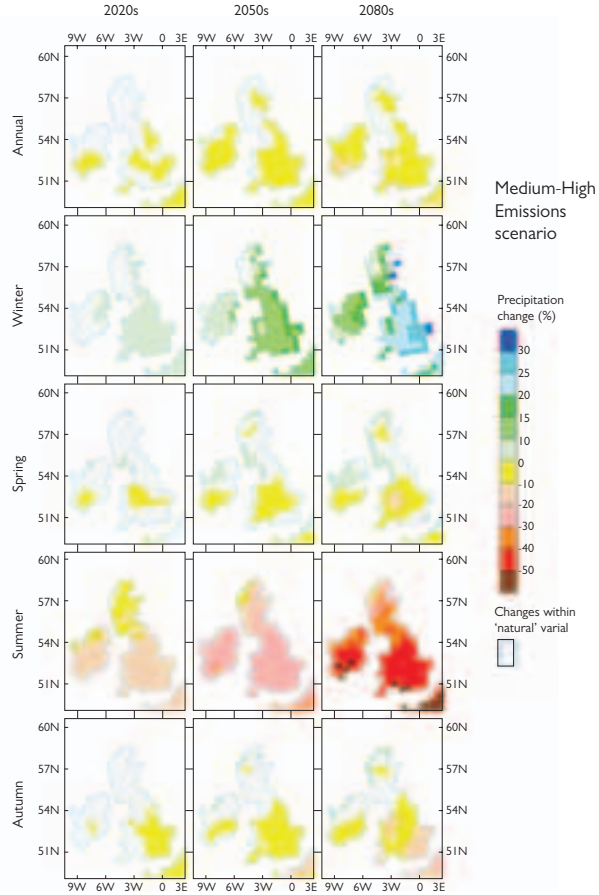
- By 2040, the average summer temperature for the UK is expected to rise by between 0.5 and 2°C, depending on region. By 2100, the average summer temperature for the UK is expected to rise by between 1 and 6°C, depending on region and emissions scenario (high confidence).
- By 2100, there is expected to be up to 50 per cent less precipitation in the summer months, depending on region and emissions scenario (medium confidence).
- The number of days when buildings require cooling is expected to increase (high confidence).

Winters are projected to continue to get milder and wetter

- By 2040, the average winter temperature for the UK is expected to rise by between 0.5 and 1°C, depending on region. By 2100, the average winter temperature for the UK is expected to rise by between 1 and 4°C depending on region and emissions scenario (high confidence).
- By 2100, there is expected to be up to 30 per cent more precipitation in the winter months, depending on region and emissions scenario (high confidence).
- Snowfall amounts are expected to decrease across the UK (high confidence), and large parts of the country are expected to experience long runs of winters without snow (medium confidence).
- The number of days when buildings require heating is expected to decrease (high confidence).

Some weather extremes are projected to become more common, others less common

- The number of very hot summer days is expected to increase, and high temperatures similar to those experienced in August 2003 or July 2006 (>3°C above average) are expected to become common by the end of this century, even under the Low Emissions scenario (medium confidence).
- The number of very cold winter days is expected to decrease, and low temperatures similar to those experienced in February 1947 or January/February 1963 (>3°C below average) are expected to become highly uncommon by the end of this century, even under the Low Emissions scenario (medium confidence).
- Heavier winter precipitation is expected to become more frequent (high confidence).



Projected per cent change in average annual, winter and summer precipitation for the 2020s, 2050s, and 2080s for the low and high emissions scenarios.
© UKCIP

- Winter storms and mild, wet and windy winter weather are expected to become more frequent (low confidence).

Sea-levels around the UK are projected to continue rising

- Global sea level is expected to continue to rise (high confidence), and by 2100 it could have risen by as much as 80cm around the UK coast, depending on region and emissions scenario (low confidence).
- There is expected to be greater sea-level rise in the south of England than in western Scotland due to variations in natural land movements (medium confidence).
- Extreme sea levels are expected to be experienced more frequently, and by 2100 storm surge events could occur up to 20 times more frequently for some coastal locations and emissions scenarios (medium confidence).
- The temperature of UK coastal waters is expected to increase, though not as rapidly as air temperatures over land (high confidence).

Confidence in these projections

Not all of the changes described by UKCIP02 are given with the same degree of confidence. Based on both expert judgement and comparison with other global climate models, some changes in future UK climate have been assigned a higher confidence than others (see designations above). When using the UKCIP02 climate change scenarios, regardless of the level of detail, it is important to understand the confidence associated with the specific changes described and to ensure that the use of the information is consistent with and fully reflects the associated uncertainties.

Another way of looking at the confidence in these projections is to compare recent climate observations with projections. The most recent observations of trends for atmospheric carbon dioxide concentrations, global mean air temperature and global sea level have been compared with previous model projections as summarised in the 2001 assessment report of the Intergovernmental Panel on Climate Change (IPCC). Comparison of the coincident periods 1990 to 2006 suggests that:

- atmospheric carbon dioxide observations are remarkably consistent with the projections;
- global mean surface temperature observations are following a trend at the upper part of the range projected by the IPCC; and
- observed sea level has been rising faster (3.3mm+ 0.4 mm/year since 1993) than the rise projected by the models (best-estimate rise of 2 mm/year).

Although the time overlap is relatively short (16 years), these results suggest that the IPCC projections have not exaggerated but may in some respects be an underestimate of the projected change, underscoring the reason for concern and need for adaptation and mitigation. ■

REFERENCE
Jenkins, G J, Perry, M C, and Prior, M J O, 2007. *The Climate of the United Kingdom and Recent Trends*. Exeter: Met Office Hadley Centre

'Doggerland', now beneath the North Sea, was once home to Mesolithic hunters. Virtual reality model reconstructed from seismic terrain data and seeded with contemporary vegetation.

The past as a guide to the future: the long-term view

Stephen Trow
Head of Rural and Environmental Policy, English Heritage

Climate changes all the time – sometimes slowly, sometimes more quickly. 20,000 years ago, for example, an ice sheet covered northern England as far south as Birmingham, while 125,000 years ago elephants and hippos lived in southern England, with Trafalgar Square among the sites where their bones have been found. While climate change has never before been driven primarily by human activity, as it is now, an understanding of this past natural variation may nonetheless provide vital clues for those trying to predict future trajectories of change.

The longest continuous records of climate come from deep ocean cores, some going back for hundreds of millions of years, in which changes in micro-fossil species, and changes in isotope ratios

in their shells, give a good record of past temperature changes. Cores through the Greenland and Antarctic ice sheets – built up from snowfall and now several kilometres thick – give a more detailed record over the past 200,000 (Greenland) to 600,000 (Antarctica) years from changes in stable isotopes in the ice, and from dust and air trapped in the ice.

Looked at against this long perspective, the last 10,000 years have been a slightly warmer interglacial during a cold and rather changeable period, the Pleistocene, which has been going on for the past 2 to 4 million years. Our present interglacial has been relatively stable, though not without change – pollen records show that in Britain and northern Europe it was probably about 1°C warmer on average during the Neolithic (4000–2000 BC), cooler and wetter in the later Bronze Age (1400–900 BC), warmer in the Roman period (AD 43–410) and in the 12th to 13th centuries, and colder between the 14th and 19th centuries, during the 'Little Ice Age', with white Christmases and ox-roasts on the frozen Thames during particularly cold winters.

Some past changes have been dramatic and often rapid. The sea level has risen by 130 metres over the past 20,000 years, since the coldest past of the last glacial, by as much as a metre a century for much of this time – a rate outstripping predictions for the next 80 years and there have been something like 20 very rapid temperature rises during the past 100,000 years.

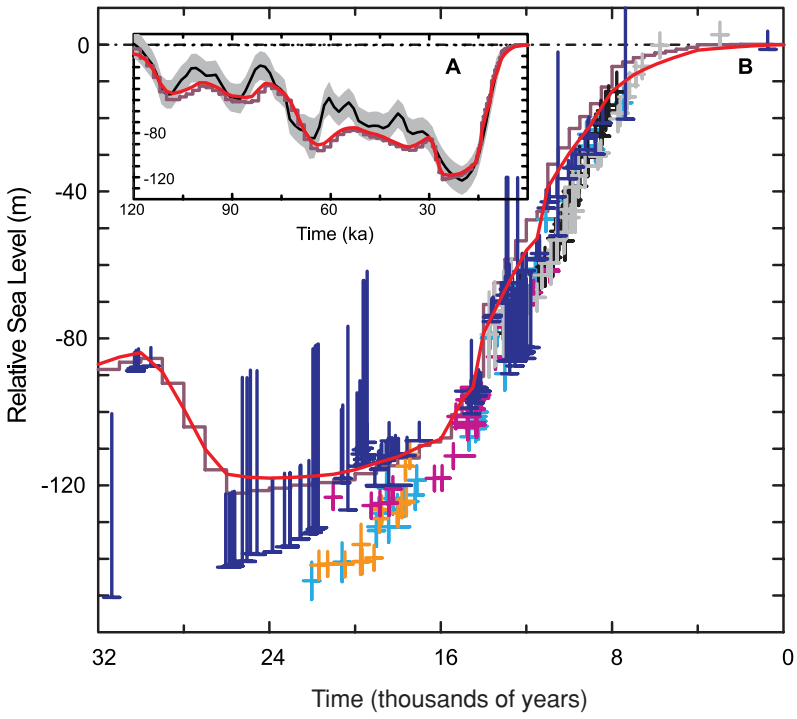
In contrast to today's populations, the people living through these dramatic changes were highly mobile bands of hunter-gatherers and total world populations probably numbered no more than a few millions. Over the last 500,000 years, therefore, Palaeolithic man was able to leave England at least twice during cold periods and re-colonise it during warmer periods. One recent study links the early Neolithic colonisation of south-east Europe around 7000–6000 BC to the loss of fertile land now drowned below the Black Sea. Similarly, the North Sea plain (or 'Doggerland') was probably home to large numbers of Mesolithic (8000–4000 BC) hunters who had to move to surrounding higher land when the North Sea was flooded by postglacial sea level rise around 5000 BC.

Today, the challenge faced by a world population of 6.6 billion – with its attendant pressures on productive land, food and water and its fixed and often low-lying cities and infrastructure – is of a fundamentally different order to those faced by much smaller and more mobile past societies. Nevertheless, there are still some significant lessons we can learn from the past and its record of climate change.

Firstly, we are developing an increasing understanding of the speed with which radical and long-term changes to climate can occur, so called climate 'flips' which are far more abrupt than scientists have previously thought possible. This knowledge must reinforce the sense of urgency with which we approach the reduction of greenhouse gas emissions.

Secondly, we can see how, in the past, it is people in productively marginal areas who are most vulnerable to change. For example, the cooler wetter conditions of the later Bronze Age ended farming in upland areas like Dartmoor and the Little Ice Age effectively terminated the Viking colonisation of Greenland. Today, this should emphasise the responsibility of both the developed and developing worlds to control future emissions if the climate impacts on today's most economically and productively marginal areas are to be minimised.

Thirdly, since the beginnings of the Neolithic, humankind has demonstrated an immense ability to innovate – especially in food production and storage, building methods and transport – in order to help people deal better with a wider range of conditions and to adapt to change. As a result of past greenhouse gas emissions, significant changes to the climate over the next few decades are



Faced with the onset of a cooler and wetter climate during the 1st millennium BC, Late Bronze Age farmers were forced to abandon their settlements on the uplands of Dartmoor.

now inevitable and society will need to devise strategies for adapting to, as well as mitigating, these changes. We will need to demonstrate, build upon and exceed the ingenuity of our ancestors if we are to do so successfully.

As part of our wider response to climate change, English Heritage's will continue to look to the past as a source of ideas for the future. This will involve the protection and, where appropriate, the investigation of historic sites that preserve a record of past climatic change and which may be of benefit to future climate change research. It will also include the lessons we can usefully draw from the low-carbon economies of past societies – an important theme in English Heritage's recent *Inventing the Future: Buildings in a Changing Climate* summit (see pp. 20–25).

Changes in global temperature lead to rises and falls in the level of the world's oceans. Since the coldest part of the last Ice Age 20,000 years ago typical sea levels have risen by 130 metres.
Source: IPCC 2007a (see p 41), Fig 6.8

Threats and opportunities: the historic environment and climate change

May Cassar
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The language of climate change can be highly scientific and everyday words can assume specific meanings. Two particular words have entered the climate change lexicon: mitigation and adaptation. These are often used casually and interchangeably by different users in different contexts. In climate science, mitigation means the actions taken to reduce the consumption of energy and water and the production of waste in order to ease future climate change. Adaptation means extending the useable life of materials and assemblies in order to adjust to present climate change.

Context

The historic environment is not facing the challenge of climate change alone. There are related sectors with which it can exchange knowledge. The construction industry uses materials, energy and water. Information can be shared on the cost/benefits of renewable energy, on waste reduction and management, and on local procurement of products and services. The management of the natural heritage through its observations of climate change impacts can inform the management of cultural heritage and cultural landscapes. For example the UNESCO World Heritage list includes cultural and natural heritage sites.

Threats, impacts and consequences

Climate change is usually perceived as a threat to the physical environment (under pressure from sea-level rise, desertification, flooding, etc) with consequences for the culture and way of life of communities. When it comes to historic buildings

TABLE 1

CLIMATE PARAMETERS	CLIMATE CHANGE RISK	PHYSICAL, SOCIETAL AND CULTURAL IMPACTS ON THE HISTORIC ENVIRONMENT
Atmospheric moisture change	Flooding (sea, river) Intense rainfall Changes in water table levels Changes in soil chemistry Ground water changes Changes in humidity cycles Increase in time of wetness Sea salt chlorides	pH changes to buried archaeological evidence Loss of stratigraphic integrity due to cracking and heaving from changes in sediment moisture Data loss preserved in waterlogged/anaerobic/anoxic conditions Eutrophication accelerating microbial decomposition of organics Physical changes to porous building materials and finishes due to rising damp Damage due to faulty or inadequate water-disposal systems; historic rainwater goods not capable of handling heavy rain and often difficult to access, maintain, and adjust Crystallisation and dissolution of salts caused by wetting and drying affecting standing structures, archaeology, wall paintings, frescos and other decorated surfaces Erosion of inorganic and organic materials due to flood waters Biological attack of organic materials by insects, moulds, fungi, invasive species such as termites Subsoil instability, ground heave and subsidence Relative humidity cycles/shock causing splitting, cracking, flaking and dusting of materials and surfaces Corrosion of metals Other combined effects eg increase in moisture combined with fertilisers and pesticides
Temperature change	Diurnal, seasonal, extreme events (heat waves, snow loading) Changes in freeze-thaw and ice storms, and increase in wet frost	Deterioration of façades due to thermal stress Freeze-thaw/frost damage Damage inside brick, stone, ceramics that has got wet and frozen within material before drying Biochemical deterioration Changes in 'fitness for purpose' of some structures. For example overheating of the interior of buildings can lead to inappropriate alterations to the historic fabric due to the introduction of engineering solutions Inappropriate adaptation to allow structures to remain in use
Sea-level rises	Coastal flooding Sea-water incursion	Coastal erosion/loss Intermittent introduction of large masses of 'strange' water to the site, which may disturb the meta-stable equilibrium between artefacts and soil Permanent submersion of low-lying areas Population migration Disruption of communities Loss of rituals and breakdown of social interactions
Wind	Wind-driven rain Wind-transported salt Wind-driven sand Winds, gusts and changes in direction	Penetrative moisture into porous cultural-heritage materials Static and dynamic loading of historic or archaeological structures Structural damage and collapse Deterioration of surfaces due to erosion

CLIMATE PARAMETERS	CLIMATE CHANGE RISK	PHYSICAL, SOCIETAL AND CULTURAL IMPACTS ON THE HISTORIC ENVIRONMENT
Desertification	Drought Heat waves Fall in water table	Erosion Salt weathering Impact on health of population Abandonment and collapse Loss of cultural memory
Climate and pollution acting together	pH precipitation Changes in deposition of pollutants	Stone recession by dissolution of carbonates Blackening of materials Corrosion of metals Influence of bio-colonisation
Climate and biological effects	Proliferation of invasive species Spread of existing and new species of insects (eg termites) Increase in mould growth Changes to lichen colonies on buildings Decline of original plant materials	Collapse of structural timber and timber finishes Reduction in availability of native species for repair and maintenance of buildings Changes in the natural heritage values of cultural heritage sites Changes in appearance of landscapes Loss of local skills Transformation of communities Changes the livelihood of traditional settlements Changes in family structures as sources of livelihoods become more dispersed and distant

and landscapes where people live, work, worship, and socialise, these consequences arise from the degradation and abandonment of sites leading to the disruption of communities and the eventual loss of rituals and cultural memory. As far as the conservation of the historic environment is concerned, abandonment raises concerns for the traditional knowledge, skills and materials that are essential to ensure proper maintenance. An assessment of climate change impacts must therefore take account of the complex interactions between natural, cultural and social aspects (Table 1).

Potential opportunities from climate change

Climate change presents opportunities as well as challenges to the historic environment. These can be:

- political: ie opportunities to identify what the public values in the historic environment. At the same time, there is the need to capture the public-value argument through better evidence.
- economic: with climate change impacts being felt at regional and local level, regional responses to climate change need developing. The role of heritage volunteers might be developed as part of an early warning system able to respond to extreme events. Furthermore, climate change could provide an impetus for the historic environment to move away from an institutionally focused ethos to a user/service ethos that can embrace public involvement in heritage protection.
- social: ie opportunities for virtual access to the historic environment, particularly among younger age groups. Climate change can serve as a catalyst for discussions among culturally diverse groups on society's priorities for safeguarding the historic environment.
- technological: innovations leading to greater affordability, searchability and retrieval of digital records could deliver greater democratisation of research. The impact of climate change will place greater demands on the creation, quality analysis, maintenance and e-delivery of records ranging from non-invasive archaeological techniques to virtual reconstructions.
- legal: the opportunity to focus planning and protection systems and civil contingency

Table 1
SOURCE
Adapted from May Cassar, 'Principal climate change risks and impacts on cultural heritage' in *Background Document UNESCO World Heritage Centre in Cooperation with the United Kingdom Government 'World Heritage and Climate Change' for the Broad Working Group of Experts at UNESCO HQ 16–17 March 2006* and in Working Document 30 COM 7.1 prepared for the 30th Session of the World Heritage Committee, Vilnius, July 2006 and also at http://whc.unesco.org/archive/2006/30com-en.htm

and emergency preparedness on managing climate change impacts.
- environmental: the opportunity presented by the growing scarcity of fossil fuels and the increase in energy prices to demonstrate alternative methods to air-conditioning to control the environment in historic properties.

Every aspect of the operation and management of the historic environment should be considered for its ability to mitigate and adapt to climate change. An overall improvement will be achieved because substantial improvements in any aspect will compensate for areas where few improvements are possible.

Key players

The key players can be grouped around the 'users' and the 'doers' of climate change research for the historic environment. The primary users are public and independent heritage organisations:

- English Heritage commissioned a scoping study, *Climate Change and the Historic Environment* (2002); led a foresight planning heritage task-group on *Construction Research and Innovation in the Heritage Sector* (2005), which included climate impact as one of the research themes; produced a policy document, *Climate Change and the Historic Environment* (2007); organised a Climate Change Summit (2008, see pp.20–25); launched a public information website (2008); and included a climate change special feature in *Heritage Counts* 2008.
- The National Trust published a report, *Forecast? – Changeable! Some Examples of Climate Change Impacts Around The National Trust*, to share some of its experiences and to outline a suggested approach for the future, as well as publishing numerous mitigation and adaptation case studies on its website. The National Trust and Magnum Photos also organised an exhibition, *Exposed: Climate Change in Britain's Backyard* with an associated poster tour and public debate, which was supported by the Defra fund, Tomorrow's Climate, Today's Challenge (2007).
- Historic Scotland carried out a scoping survey into the effects of climate change upon the fabric of the built historic environment to gather the current level of knowledge and to determine gaps in the knowledge that can be addressed by future research.
- The Council for British Archaeology organised a one-day conference, Adapting Archaeology: Foresight for Climate Change (2007).

The key doers are universities, including University College London, the University of East Anglia and Glasgow Caledonian University, which work collaboratively on both basic and applied research and disseminate information to other scholars, heritage organisations and the public.

The contribution that the historic environment can make to increasing knowledge on climate change is being noticed by policy-makers and research-funding bodies including the United Kingdom Climate Impacts Programme, the joint Arts and Humanities Research Council and the Engineering and Physical Sciences Research Council's Science and Heritage Programme. At an international level, the European Parliament Temporary Committee on Climate Change (CLIM) invited evidence to be submitted to it on climate change impacts on cultural heritage (2007) and the UNESCO World Heritage Committee working with its advisory bodies (ICOMOS, IUCN, ICCROM) has agreed a policy on climate change and world heritage (2007).

Key knowledge gaps and research needs

Table 2 lists the research areas and research outputs that have been identified as required to help reduce gaps in knowledge and meet recognised research needs.

Table 2

SOURCES

1 UCL, *Climate Change and the Historic Environment*. English Heritage, 2005
2 UEA, Scoping Report, *Sector Research Activity*, English Heritage, 2004
3 European Parliament, *Technical Requirements for Solutions in the Conservation and Protection of Historic Monuments and Archaeological Remains*. Final Report, Scientific and Technological Options Assessment Unit, 2001
4 CRISP, *Construction Research and Innovation in the Heritage Sector*. Foresight Planning for a Research Strategy for the Construction Industry, prepared by English Heritage, Draft Report MK1, 2005
5 EPSRC, *Engineering Historic Futures*. Stakeholder Dissemination and Scientific Research Report, UCL, 2007
6 The United Kingdom Parliament, *Memorandum by University College London*, Select Committee on Science and Technology Minutes of Evidence, 2006
7 UNESCO, *Working Group Meeting to Develop the Policy Paper on Impacts of Climate Change on World Heritage Properties*. Background Document, February 2007
8 UNESCO World Heritage, Item 7.1 of Provisional Agenda: *Issues related to the State of Conservation of World Heritage Properties: The Impact of Climate Change on World Heritage Properties*. WHC-07/31.COM/7.1, Paris, 23 May 2007

TABLE 2

		SOURCES							
		1	2	3	4	5	6	7	8
RESEARCH OUTPUTS	Hazard recognition and risk quantification and prioritisation	●					●	●	●
	Extreme weather effects: damage probabilities and conservation	●				●		●	●
	Cross-field monitoring (eg interaction among different ageing/decay mechanisms; reconciling different metrics	●	●	●		●	●	●	●
	Simulation modelling (eg CFD modelling of env. and phase changes and amplification mechanisms)		●	●				●	
	Predictive modelling of real complex phenomena	●		●			●	●	
	Indoor/outdoor monitoring and assessment of vulnerability/ performance	●				●		●	●
	Materials interface: Environment – new–old	●	●	●			●	●	●
	Conservation and maintaining value		●						●
	Materials conservation and sustainability eg marker; durable; traditional; new repair/conservation		●	●			●		
	Response of materials and assemblies to microclimates		●	●					
	Long-term behaviour of materials eg nanoscale degradation and treatment			●					
	Biodeteriorattion and biotechnology			●				●	
	Traditional and advanced physical and chemical technologies; re-engineering of techniques and instrumentation			●			●		●
	Environment, the low carbon economy, renewable energy and historic buildings				●	●	●		
RESEARCH AREAS	Remote sensing, bio-sensing and fail-safe technologies	●	●	●			●		●
	Non-destructive/micro destructive techniques	●							
	Simulation and IT tools	●	●				●		
	Datasets, databases and mapping	●							●
	Adaptations to climate change	●							
	Wireless protocols for data transmission	●							
	Indicators, thresholds and standards	●	●	●			●		
	Damage mitigation strategies for materials and assemblies		●	●					
	Integrated conservation management and public values		●	●				●	

Anticipating the Impacts

Climate change is happening – but what effects is it going to have on different components of the historic environment?

Climate change will have significant impacts on almost every part of the historic environment, but those impacts will not necessarily be the same from one facet to another. For historic buildings it is likely to be a battle to keep out the rain (Watson, pp 12–13), while for park and garden managers it will be a matter of adapting to warmer summers and longer growing seasons (White, pp 14–15). In the countryside, the greatest impacts will come from changing agricultural practices (Smith pp 15–17), but on the coasts they will come from flooding and erosion (Murphy pp 17–19).

Adapt and conserve!

Alan Watson
Head of Land Use Planning, National Trust

Every other news bulletin appears to be the bearer of yet worse predictions of future climate impacts, whether it be on our natural and built environment and the services it provides, or on our economy and society. A Met Office scientist was recently quoted as saying that destructive changes in temperature, rainfall and agriculture were now forecast to occur several decades earlier than previously thought, affecting us, rather than our children and grandchildren.

The National Trust owns a huge variety of buildings, gardens, parklands and other heritage assets, large areas of open countryside of conservation importance, and more than 700 miles of coastline. It is thus very well placed to understand many of the impacts of climate change that are already occurring within the UK. (The Trust is also only too well aware that its own carbon footprint is enormous, largely because of car-borne visiting to properties. This poses the Trust a real challenge, particularly given its reliance on visitor income to conserve its estate).

The main impacts on the historic environment

The Trust's experience suggests that, although there will be considerable regional and local variation, the key adverse impacts on the historic environment will be:

- the flooding of buildings/structures – either from fluvial, flash or coastal flooding associated with sea-level rise and storm surges
- rainwater penetration into historic buildings, sometimes affecting historic contents
- subsidence of buildings, especially on clay soils, eg in the South-East
- changes to historic parks and gardens, such as storm damage to veteran trees or historic plantings, the changing climate affecting the viability of certain garden designs/varieties
- the spread of pests and diseases as a result of a warmer climate and milder wetter winters, which will have an effect on gardens/ornamental species and damage to chattels, interiors and furnishings
- the loss of historic sites through accelerated coastal erosion associated with sea-level rise.

Examples of impacts

The Trust is seeing a steady increase in the number of climate-related incidents. While an individual flood or storm event cannot be attributed solely to climate change, it is clear that a pattern is being established of more frequent heavy downpours and gales, and this is reflected in the number of Trust's insurance claims for storm and flood damage, which are rising. In 2007 alone a number of freak storms occurred, resulting in the loss of parkland trees at sites like Nostell Priory, Hardwick Hall and Polesden Lacey; the flooding of countless buildings and historic parks, such as Charlecote and Buscot (especially in July);

Charlecote Park, Derbyshire. During the summer of 2007 freak storms resulted in the flooding of countless buildings and historic parks – a reminder to the National Trust of the huge conservation and financial implications of a changing climate.

Insect infestation at Tyntesfield, North Somerset. The spread of pests and diseases as a result of a warmer climate and milder wetter winters will pose new threats to the chattels, interiors and furnishings of the nation's great historic houses.
© NTPL/Nadia Mackenzie

Grey's Court, Oxfordshire. One vital way of adapting historic buildings to withstand the impact of increased rainfall is to install larger and more efficient rainwater goods – even if these have to differ from those with which important listed buildings were originally supplied.
© National Trust

and rainwater penetration at Hinton Ampner, Calke Abbey, Hughenden, Dudmaston and Knole.

These events can have both conservation and financial implications. For instance, during July Coughton Court in Warwickshire was flooded by the River Arrow for only the second time in its history. The mansion remained shut for seven weeks, losing revenue from an estimated 20,000 visitors. A large clean-up operation took place to save the contents, but inevitably some damage was incurred which required repair. Not all costs can be met by insurance.

Similarly, torrential rain in June at Calke resulted in water ingress through the roof as the capacity of roof rainwater goods was overwhelmed. This caused damage to wallpaper, decorative surfaces, paintings, books, furniture, carpets and floors. At the same time flash-flood water entered the property at ground-floor level.

The longer-term trends such as accelerated coastal erosion will also impact on the historic environment. The Trust's Coastal Risk Assessment process suggests that no fewer than 169 of the Trust's coastal properties covering more than 600km will lose land to erosion during this century. Within those stretches of coast will be archaeological sites or historic structures that it will not be possible to protect.

The Trust's overall policy on climate change impacts and adaptation

One of the biggest challenges the Trust faces is that of philosophical approach. Many of its staff have been brought up in the tradition of conservation actually being translated as preservation. The Trust has come to recognise that conservation is really about the understanding and managing of change. Its adopted Statement of Intent and principles on climate change therefore include the following statements:

- *We recognise that we have to adapt to climate change and will seek to optimise the opportunities and minimise the risks arising from climate change.*
- *The Trust understands that climate change cannot be accurately predicted.*
- *Conservation is about the management of change. It will not always be possible to preserve our properties and chattels entirely unchanged.*

These statements of policy are all very well, but need to be fully implemented – a real challenge when most management is delegated down through the regions to individual properties. Implicit within them are many difficult choices based on assessments of risk and value of asset, but the overall philosophy is clear.

Actual examples of proactive adaptation to the Trust's historic assets remain few at the time of writing, but will increase as opportunities and budgets allow. One good example is changing the specification of roofs and/or rainwater goods to cope with increased rainfall intensity: Grey's Court has already been modified with larger capacity rainwater goods, and roof works are under way at Dunster Castle and about to start at Hanbury Hall and Calke Abbey. These are all listed buildings but from the Trust's point of view adaptation while maintaining overall integrity is greatly preferable to incremental damage. The Trust looks forward to the regulatory processes for its historic environment fully reflecting the inevitability of climate impacts and adaptation. ■

Growing with climate change – planning adaptation in parks and gardens

Jenifer White
Senior Landscape Advisor, English Heritage

'The English country garden is unlikely to survive in the South-East beyond the next 100 years.' This and headlines like 'the great British lawn could become increasingly difficult and costly to maintain and some traditional garden features may have to be replaced by new ones, more suited to changing conditions' have hit the headlines over the last few years. Journalists have picked up the horticultural sector's report, prepared in conjunction with the Defra-funded UK Climate Impact Programme, scoping the likely impacts of climate change on gardens, parks and the horticultural industry (Bisgrove and Hadley, 2002). Since this report, more guidance publications have been issued. Most are aimed at the domestic sector and focus on single issues such as drought-tolerant planting schemes or minimising flood damage whereas gardeners are likely to face both hotter, drier summers and wetter winters with heavy rainfalls.

The changing weather pattern is already discernible. Over the last 40 years there have been several notable extreme weather events affecting gardens. The severe winter of 1962–3 killed many hardy plants; the 1976 drought weakened trees and dried out lakes; more than 15 million trees were felled by the 1987 storm and nearly 50 per cent of the registered historic parks and gardens were damaged. Two years later more areas were damaged by storms, and there were significant floods in 2000, 2001 and 2007. UKCIP has shown that heat waves are now more frequent in summer, and there are fewer frosts and winter cold spells. The cumulative effect is that the growing season has extended by one month since 1900.

Higher summer temperatures and increased CO_2 levels enhance plant growth too. It has become increasingly easy to replicate exotic planting schemes that would have been prized demonstrations of Victorian horticultural expertise. Winter water logging (and its associated problems) causes stress and dieback in plants and can result in nutrients being leached out of the soil. A warmer climate could mean more pests, weeds and diseases. Over the last couple of years horse chestnuts, often a feature of historic designed landscapes, have been blighted by Bleeding Canker (an infection increasingly leading to fatalities) and a new leaf-miner moth.

Gardens and green spaces in urban areas will play an increasingly important role in tempering the 'heat-island' effect and run-off from heavy downpours. Popular on warm days, public parks are likely to be refuges if summers continue to get hotter. Garden design has always sought to create microclimates with features like shady pergola walks and cooling fountains, or sheltered garden seats capturing the winter sun. The University of Manchester's Adaptation Strategies for Climate Change in the Urban Environment (ASCCUE) research project has shown the importance of this urban green infrastructure in tempering the heat-island effect. In addition street trees, gardens and features such as climbing plants could help cool buildings (or insulate them in winter) and improve air quality.

The green infrastructure needs to be well maintained and kept green if it is to be functional in offsetting climate-change impacts. Instead of developing this green infrastructure we are witnessing a loss of front gardens, infill in leafy suburbs and a shift in street-tree planting schemes to the use of smaller short-lived species. Moreover, many green spaces are still in a poor condition.

Professional gardeners and landscape managers work with the weather every day, every season. They are naturally interested in climate-change science and its implications for conservation, plants and wildlife, and in opening the sites as visitor attractions. There is a growing debate about how best to perpetuate our legacy of historic parks and gardens in these conditions. Alarming headlines and research about individual tree species like beech stimulates questions about

Forestry Commission research suggests that south-east England is likely to become unsuitable for beech forest plantations because of high moisture deficits. There is concern about the future of ancient trees like these beeches at Burnham Beeches, photographed a hundred years ago by Henry Taunt.

Exotic *Canna* and *Ricinus* in the Victorian-style parterre borders at Osborne.
James O Davies

whether current conservation strategies will continue to be sustainable. We do need to be thinking about such implications but it is also essential to understand the scope of the research, the timescales involved and local variations. For example, current research on tree species concentrates on plantation forests and timber production rather than amenity features such as parkland trees.

The UKCIP 2002 climate change scenarios provide three timescales and three levels of emissions, yet most analyses look only at the 2080s' high emissions scenario. The garden sector needs to collaborate with the other land-management sectors to examine ways of using current research, and to develop a long-term research strategy and new management techniques for sites like historic parks and gardens.

The role of the professional gardener and landscape manager is about managing change. High-quality management and maintenance can stem climate-change effects and minimise risks like storm damage. Of course trained personnel and adequate resources are essential. But before making decisions about climate-change adaptation, the first priority must be to understand the significance of each site and its special features and characteristics, monitoring and tracking the climate-change impacts. English Heritage's *Conservation Principles* (English Heritage 2008) offer a strategic framework for making decisions about change, while conservation management plans provide tools for monitoring and planning new infrastructure or management practices. All conservation management plans for historic parks and gardens should now address climate change, even if at this stage they only develop a strategy to monitor changes and scope future needs. Garden management can also be reviewed to improve energy efficiency and reduce carbon emissions, and like the National Trust, garden managers can involve visitors in discussions about future changes and mitigation measures such as on-site recycling. If eventually climate change extremes do lead to decisions to abandon historically important gardens, they will need to be fully recorded before being damaged or lost. ■

Green spaces like Princes Park in Liverpool will play an important part in cooling cities in hot summers and providing attractive places to relax in the heat.
James O Davies
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All change in the countryside?

Ken Smith
Chair, Association of Local Government Archaeology Officers UK

Direct impacts of climate change on the rural historic environment include rising sea levels, inundation and rainfall in more-intense bursts. Extreme weather events will probably cause more-frequent and severe flooding. Cropping regimes are likely to change, with less land left bare over winter. Farm buildings will be required to house stock that currently over-winter outside or stocking levels may have to be reduced to avoid erosion of wet land by animals and equipment. Increased temperatures will reduce soil moisture and cultivation patterns are expected to shift as arable farming moves north in pursuit of higher rainfall. If soil-moisture levels fall, this will dictate

Ladybower Reservoir, looking north towards Derwent Reservoir, Peak District. Air-pollution levels in this area are already high, brought in on the prevailing westerly winds. The crises affecting upland farming are likely to be exacerbated by more severe weather events with their inevitable impacts on stocking levels and agricultural-land management. The increased likelihood of summer droughts, moorland fires and increased run-off will impact on landscape character, vegetation and tree cover as well as on issues such as water catchment and quality.

which crops are grown and how the land is managed; deep-rooting crops have a significant impact on buried archaeology, through ground preparation, root penetration, de-watering and harvesting. The appearance of historic landscapes will also change as farmers need to accommodate larger or different machinery. Increased demand for summer stock shelters is likely in remote locations with impacts on the character of the historic landscape, on traditional farm buildings and on any associated buried archaeology. Conversely, lack of such provision could see abandonment of land with equally detrimental consequences for archaeology and landscape character.

Fewer frosts mean more pests, so traditional planting schemes in historic parks and gardens will become increasingly difficult to maintain (See White, pp 14–15). Historically authentic tree planting schemes will also become untenable.

It has been suggested that beech trees will be the first to be affected by increased temperatures in the South and East, with a loss to local distinctiveness and landscape character. We need to re-examine the philosophical bases used to justify both woodland management and traditional garden planting schemes. We claim that we are managing change, but are we? Do we maintain the status quo more than we manage change? We need to identify ways to inform prioritisation, because we are going to lose many sites and landscapes without appropriate recording.

Indirect threats from society's response to climate change include biofuel and biomass crops. Both have implications for the historic environment through impact on historic landscape character, root penetration and de-watering, not all of which are fully understood. Production conflicts – food or fuel? – and increased prices

Land below Bretton Edge, Peak District. This pastoral idyll could be under threat as agriculture responds to changing climatic conditions. These changes could range from the enlargement of fields to accommodate changing stocking regimes to the introduction of larger machinery, if arable farming moves north in search of moisture. The need for remote stock shelters against extreme weather events – rain or sunshine – could also have a significant impact on the character of this quintessential Peak District landscape.

Ridge and furrow, Bradbourne, Peak District. Many of the infields around the Peak District's medieval villages have been ploughed flat, the ridge and furrow fossilised in the pattern of the later field walls. The few examples left could be under threat from climate change – changing stocking levels and types, the need for more shelters, a move to arable.

seem inevitable. Intensification of agriculture is likely to be the answer as commodity prices increase. Defra's Environmental Stewardship Scheme is already experiencing some resistance to sign-up in the face of the current increase in wheat prices.

57 per cent of English Grade 1 farming land, containing great numbers of archaeological sites, lies below 5m OD, with a significant proportion at risk either of loss, episodic inundation, salination, storm surges or severe weather events. Drier summers and soils could see traditional arable crops move from the South and East to the North and West, where inevitable intensification of agriculture will involve the ploughing of existing pasture. Replacing that pasture could see old intake again under cultivation and new pressure on moorland itself to provide grassland for flocks and herds.

Some generic adaptation principles have been proposed by our biodiversity colleagues to reduce vulnerability and manage for rural uncertainty (Mitchell *et al* 2007), and these are equally applicable to the historic environment. They cover ways to reduce direct and indirect impacts, increase resilience and accommodate change. Key requirements are monitoring and surveillance, development of a more robust evidence base, better knowledge transfer and more effective communication.

Research is needed to improve our understanding of the impacts of climate change on the rural historic environment and to develop evaluation and management methodologies. At the same time, the impacts of existing and proposed adaptation policies should be quantified locally, regionally and nationally. Robust headline indicators of climate change impacts on the historic environment need to be developed and tested. Above all, the increased understanding resulting from this research must be input into legislation, policy and practice.

When first launched by Defra in 2002, the England Biodiversity Strategy, which seeks to ensure that every aspect of public policy works with the grain of nature and ecosystems rather than against them (**www.defra.gov.uk/wildlife-countryside/biodiversity/biostrat/index.htm**) identified seven key messages:

- climate change is happening
- it is a new and rapidly growing threat
- we need to revise our approaches
- we need to start to adapt our policies and activities now
- there are many things we can do on the basis of existing knowledge
- our understanding of impacts is still developing
- we need to cope with an uncertain future

These are all relevant to the historic environment sector. They underline the need for partnership, not just those with those with whom the threats and solutions have resonance – in biodiversity, agriculture and landscape management – but with those involved with town and country planning, minerals provision and the development of legislative and policy responses who are also seeking solutions to this common problem. ■

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Out to sea: climate change and the maritime historic environment

Peter Murphy, Chris Pater and Mark Dunkley
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The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) expresses 'very high confidence' that humanly induced climate impacts have led to a net warming of global climate since 1750. Coastlines are being affected now (IPCC 2007a, 2007b). An increase in the mean rate of global sea-level rise has been recorded already (1.8mm per year overall in 1961–2003, but 3.1mm per year in 1993–2003), resulting from thermal expansion of the oceans

Buildings on a cliff-edge at Happisburgh, Norfolk. Cliff erosion threatens historic assets at many locations, and frequently the Shoreline Management Plan option is 'No Active Intervention'. The boulders in the foreground mark the line of the cliff in the 1990s.
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combined with an input of glacial melt-water. In the future, models suggest increased frequency of heavy precipitation events and it is possible that storm intensity will increase. There could be a mean rise in sea levels globally of between 28 and 43cm by 2100, though this could easily be an under-estimate as the effects of ice-sheet flow were intentionally excluded, and more recent studies suggest that atmospheric CO_2 concentrations are rising more rapidly than previously thought.

The maritime historic environment includes archaeological sites (from lithic scatters relating to the earliest human presence around 700,000 years ago onwards), historic buildings and structures (Roman shore forts to Cold War establishments), historic wrecks (from Bronze Age sewn-plank vessels to Second World War casualties) and entire coastal landscapes (many of which were transformed into agricultural land from mudflat and salt-marsh by embankment as long ago as the 8th–9th centuries AD). Climate change impacts on them fall into four main categories:

- direct physical impacts causing accelerated erosion or increased flooding
- indirect impacts that are a consequence of decisions taken now by coastal managers anticipating future climate change
- indirect impacts related to attempts at climate change mitigation (principally expansion of the renewable energy sector)
- invasion of alien fauna from more southerly latitudes.

Many direct impacts of climate change on the sea and coast are part of long-term processes that originated in the late glacial period around 12,000 years ago: they are not new. Nevertheless, there are now strong grounds for thinking that the *rates* of coastal processes will increase in the future. These processes include: increased cliff erosion as a result of rising relative sea-levels; loss of beaches; increased 'rotational failure' of unstable cliffs after heavy rain; loss of saltmarsh due to 'coastal squeeze';* breaching of coastal dune and spit barriers; and increases in the severity and frequency of flooding. Archaeological sites, historic buildings and ultimately whole landscapes will be lost. Mitigation measures, including excavation and recording of sites before their loss, and relocation of buildings, have already been initiated in some places, but in a situation where hundreds of historic assets are threatened full mitigation is likely to be possible only for those of special interest.

Shoreline Management Plans (SMPs), produced by the coastal groups of local authorities and the Environment Agency with Defra guidance, set the broad management framework for coasts over 0–20, 20–50 and 50–100-year time-scales (McInnes 2003). The aim is to 'manage risk . . . to people, and the developed, historic and natural environment' in a sustainable way (Defra 2006). For each Coastal Policy Unit – a discrete definable length of coast – one of four options is selected: 'Hold the Line', 'Advance the Line', 'Managed Realignment' or 'No Active Intervention'. The preferred option will depend, among other factors, on risk management, on the value of assets that could be protected (from houses to nuclear power stations) relative to costs

* Coastal squeeze occurs where an area of saltmarsh is 'trapped' between a rising sea level and hard defences, such as sea-walls, and progressively erodes. Saltmarsh sediments contain numerous well-preserved archaeological sites and structures.

Research conducted at Scroby Sands Offshore Wind Farm into the scour effects around turbine foundations provides useful detail to inform mitigation strategies for the historic environment.
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Blakeney Chapel, a Scheduled Monument on the north Norfolk coast, was excavated in advance of its destruction by landwards spit migration. Funding was provided by the Environment Agency as part of a Managed Realignment scheme.

of defences, and on the requirement to comply with nature conservation legislation and biodiversity obligations. English Heritage has provided guidance for coastal managers (2006), and is commissioning a programme of Rapid Coastal Zone Assessment Surveys to enhance the coastal NMR and HERs and thereby permit informed contributions to SMP production. However, the historic environment is only one of many factors to be considered in option selection. Options which will adversely affect sites and buildings are bound to be selected for some lengths of coast in most, if not all, SMPs. In those cases mitigation measures will be needed.

Climate change mitigation, in terms of reducing carbon emissions from power generation, is partly focused on the increased use of renewable energy resources. At present, offshore wind farms are providing the most significant contribution. The implications for the historic environment from large-scale offshore arrays relate to direct or indirect construction impacts on wrecks and submerged prehistoric land surfaces. It is therefore essential that Environmental Impact Assessments include desk-based assessment of potential archaeology, combined with geophysical and geotechnical investigation, to define the resource and ensure effective archaeological mitigation. In September 2007, the government announced a feasibility study of the proposed barrage across the Severn Estuary for tidal energy generation. Barrages of this type plainly could have severe impacts on submerged and coastal archaeology.

Rising ocean temperatures are already resulting in expansion northwards of organisms such as *Lyrodus pedicellatus*, a species of shipworm that, unlike the northern species, is active all year, thus constituting a major threat to wrecks and other archaeological wooden structures. It has been recorded in Langstone Harbour and on the *Mary Rose*. New terrestrial colonists may also be expected: there is already a population of North African scorpions in the 18th-century Sheerness dockyard wall, which causes problems during maintenance.

Archaeological sites, historic wrecks, buildings and landscapes on the coast and offshore are already being affected by climate change and this situation can only get worse. Protection of some assets – especially those on developed coasts – will be possible, but elsewhere mitigation rather than conservation will be needed. Some difficult decisions will have to be made on prioritisation and funding allocation and in the end we will simply have to let some assets go.

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Inventing the Future

Rowan Whimster, *Editor,* Conservation Bulletin

Traditional buildings have a huge part to play in the battle against climate change – but first we need to understand much more about how they work.

Facing up to the facts

Our houses (or more accurately their energy-consuming occupants) are responsible for more than a quarter of this country's CO_2 emissions – roughly the same proportion as transport and industry. And of those 22.7 million homes, nearly a fifth were constructed before the end of the First World War. It is therefore hardly surprising that carbon economists and policy-makers have begun to ask hard questions about the traditionally built houses, hospitals, schools and factories that give our urban and rural environments so much of their special character. In the face of global warming is it true, as some experts have argued, that older traditionally constructed buildings are fundamentally inefficient in terms of their energy efficiency and will therefore need to be knocked down and replaced by so called 'zero-carbon' houses?

Rather, is the problem more to do with us, the people who live in the houses – who turn up the thermostat when we feel chilly and then open the windows when we get too hot; who never quite get round to improving the draught-proofing of our windows and doors? And if we are prepared to make some modest changes to our personal lifestyles, how much effect will that have on the energy consumption of the national stock of buildings in which we live, work and entertain ourselves? Finally, when it does come to new development, what lessons can be learnt from the past about more sustainable ways of constructing, heating, lighting and ventilating buildings?

To answer these questions, English Heritage invited more than 100 delegates from across the spectrum of the built environment to meet at the Royal Society in London on 24–25 January 2008. Their shared purpose was to learn about the challenges facing the nation's traditional building stock and to sketch a vision of how those buildings, far from being a dangerous liability, have the potential to serve as a model and catalyst for new and more sustainable ways of low-carbon living. Assisting them in this task a panel of distinguished historians, economists and researchers introduced some of the issues relating to the energy efficiency of traditional and contemporary buildings and construction materials. Stimulated by this evidence, the summit participants were then asked to explore the role that the built environment could and should be playing in the battle against climate change.

Opening the summit, **Margaret Hodge** (Minister of Culture, DCMS), laid down three powerful challenges. The first is that our sector's unique understanding of the sustainable building techniques of the past needs to play a crucial part in planning for the future. The second is that familiar and cherished buildings are of huge positive value to people – in her own words: 'The more you destroy old housing, the more you destroy communities and social cohesion.' The third and arguably most important message was that government is looking to the historic environment sector to robustly challenge the simplistic and unproven argument that old buildings are by their nature inefficient.

In his own welcoming address **Simon Thurley** (Chief Executive, English Heritage) responded to the Minister's challenges with two more of his own. The first is that our sector has no option but to accept that 'the journey from a high to a low-carbon world must be as straight and direct as possible'. The second is that, as the stewards of the historic environment, we are 'not wanting to idealise the past, but to learn from it'.

Margaret Hodge MP, Minister of Culture, opens the Inventing the Future summit by reminding delegates of the central importance of local buildings and places to communities and social cohesion.

Little Hall, Lavenham, Suffolk: vernacular timber-framed, earth and stone buildings can all teach us important lessons about sustainable living.

'Are traditionally constructed buildings *really* energy-inefficient? You must challenge those who still argue that the historic environment is a threat to the future.'
Margaret Hodge, Minister of Culture

Invited to set the summit's discussions in a global context, **Martin Parry** (Intergovernmental Panel on Climate Change) began by reminding delegates of two inescapable facts: that anthropogenic warming is now an unequivocal reality, and that if average global temperature rise cannot be contained below 2°C the planet and its human communities will be in for a very rough ride. For the UK, however, the impacts of climate change may at first sight seem modest, and perhaps even welcome: warmer winters, sunnier summers and for farmers and gardeners a longer growing season. Behind this superficially comforting picture there nevertheless lie some much harsher realities: increasingly frequent extreme weather events, flooding due to rising sea level and storm surges, and above all the indirect social and economic consequences of much more extreme climate changes in other parts of our small and crowded planet.

Looking ahead, the messages from the IPCC for society are equally stark: unless it is prepared to rapidly and radically adapt from its present path of accelerating global economic and population growth to one of more sustainable low-energy local stewardship there will be no way in which we will fend off the precautionary 2°C rise in global temperature. More positive, though, was Professor Parry's concluding reminder that '90 per cent of the difference between the scenarios is due to differences in future management, *not* differences in the amount of climate change'.

Learning from the past

Introducing the first full session of the summit **Edward Impey** (Director of Research and Standards, English Heritage) reminded delegates of the rich diversity of building techniques that had evolved during the centuries when energy was a scarce and expensive commodity. The past may not always have been a comfortable place, but in their struggle to buffer the surrounding environment its inhabitants learnt some practical lessons that we would be foolish to ignore in our own battle against climate change.

Going back to the world of medieval and post-medieval England, **Oliver Rackham** (Cambridge University) painted a more detailed picture of a pre-industrial society whose vernacular dwellings were usually constructed of locally sourced and often recycled materials. Timber, mud, thatch and stone all offered good structural and thermal properties at the cost of little but human energy; by contrast, the newly fashionable brick and tile depended on much more expensive carbon energy for their firing. Another example of cultural taste overriding practicality is the way in which some medieval town-dwellers insisted on building elaborate timber-framed houses even in parts of the country without easy access to local wood. **Paul Oliver** (Oxford Brookes University) explained that it was during these centuries that the sophisticated masonry, wood working, bricklaying and plastering techniques that give our historic towns and villages their distinctive character were evolved, along with the repertoire of familiar personal craft-names that go with them – Mason, Carpenter, Carver, Smith, Straw, Thatcher and the rest.

It was only with the dawning of the Industrial Revolution in the late 18th century that the low-carbon economy of the prehistoric, Roman and medieval periods finally and dramatically gave way to the high-carbon economies of the coal and oil ages. As **Barrie Trinder** reminded us, the rise of coal-fired steam power led to a rapid decline in the use of the traditional renewable resources of wind and water. At the same time, carbon-hungry brick and iron quickly replaced more traditional materials for the construction of the millions of dwellings and thousands of factories, offices and public institutions demanded by the new urban industrial society – a construction boom whose legacy is the vast amount of

A tale of two centuries: Denys Lasden's recently refurbished Grade II* Keeling House (1959) rises above a terrace of traditional 19th-century houses in Tower Hamlets – very different kinds of housing that each have a vital role to play in the battle against climate change.
© Nigel Corrie, English Heritage Photo Library

environmental capital locked up in the bricks and mortar of our Georgian and Victorian terraces, mills, warehouses, schools, hospitals and town halls.

Returning to the social and economic realities of the pre-industrial age, **Christopher Dyer** (Leicester University) emphasised two important truths. The first is that it is only a tiny minority of medieval houses that have survived to the present day – those that were built with good-quality materials at times of relative economic stability. The second is the way in which 17th-century builders adapted promptly to the challenges of their own Little Ice Age by providing their houses with smaller rooms, draught-proof glazed windows and efficient integral chimneys. By contrast, as **Geoff Clifton** (Gifford Ltd) noted, it was the failure of other great historic city-based cultures, such as those of Harappa and Angkor Watt, to adapt to changing conditions that led to their cataclysmic social and economic collapse.

Reiterating the theme that it is human behaviour as much as the behaviour of buildings that will be the key to a low-carbon future, he concluded the session with two important messages. The first is that having evolved from a high-human/low-carbon society to a low-human/high-carbon one we now have to re-learn the lessons of an intermediate stage in which a reduction in the investment of human energy is offset by increased use of non-carbon renewable energy. The second concerned the recent discovery that court buildings constructed before 1900 outperform their 20th-century counterparts in terms of energy efficiency (see p 28) – another invaluable reminder that the past has many important things to tell us if we are only prepared to listen.

Understanding the new pressures

Moving from the past to the present, **Roger Bowdler** (Head of Territory Designation, English Heritage) identified one of the key challenges facing the historic environment sector: how do we protect our heritage while simultaneously taking action against climate change? Conservation has necessarily shifted from trying to prevent change to managing it appropriately and proportionately. In the coming months the government will be publishing its new Heritage Protection Bill – an unrepeatable opportunity for us to adopt a more positive and constructive way of placing the inheritance of the past at the service of the future. But for that to happen we have first to ask some serious questions: just which buildings do we want to designate for the future, which ones are we prepared to adapt, and which may we be willing to see disappear altogether?

Moving on to the nation's contemporary building stock **Tony Travers** (London School of Economics) outlined the powerful economic pressures that will confront housing policy-makers in coming years. In a crowded country facing the realities of climate change, the most important priorities will be to make more efficient use of land and greener use of our new and existing buildings. In turn, it is through the planning system, linked to higher standards of urban design and greater public participation, that government can bring about the major changes to the supply and maintenance of the built environment that are so urgently required – though in the process we should not forget that in the end it is communities that make themselves, and not urban designers.

Another priority will to be make sure that the country has access to the building and craft skills upon which successful maintenance and adaptation of its stock of traditional buildings will depend. Those same skills will also be in increasing demand as we seek to make greater use of sustainable techniques and materials for new buildings. As **Mark Farrar** (ConstructionSkills) observed,

the United Kingdom has been unable to meet the demand for skilled labour in a construction industry that has actually witnessed something of a renaissance in certain traditional skills such as thatching. To make good the shortfall and to avoid the demographic time bomb of an ageing specialist workforce, better training provision is a top priority. More seriously, the construction industry as a whole has yet to be persuaded of the true importance of craft skills, not only for maintaining the nation's millions of older buildings but to allow a new generation of energy-efficient houses to make better use of traditional sustainable construction techniques.

Turning from the construction of buildings to the way in which they perform, **Philip Steadman** (University College London) showed that we now have the benefit of a robust body of statistical data dating back as far as the early 1970s. Altogether, housing is responsible for a quarter of national CO_2 output, roughly the same as the industrial and transport sectors. Of the UK's 23 million dwellings, 90 per cent now have roof insulation, 70 per cent are double-glazed but only 33 per cent have insulated cavity walls. Since 1974, domestic heat-loss has been falling, but overall household energy consumption remains constant due to an inexorable growth in the use of energy-hungry electric lighting and appliances.

36 Beaufort Gardens, Chelsea. The Royal Borough of Kensington and Chelsea's 'flagship home' has shown how a 63 per cent reduction in CO_2 emissions can be achieved without compromising a building's special character.

Informing the future

Having examined the past and present, the summit turned its attention to the future. **Bill Martin** (Conservation Director, English Heritage) began with the blunt reminder that we have no choice but to use the stock of buildings we already have – even though 3.6 million of our 4.6 million pre-1900 buildings do not have cavity walls. Adapting these buildings as best we can is an unavoidable necessity, but we must also remember that ill-considered and unsustainable adaptation can sometimes be worse than no adaptation at all. Before rushing to act we also need to be sure how much of the problem really lies with the buildings themselves rather than with the energy consuming behaviour of the people who occupy them.

In response to this challenge **Sarah Staniforth** (National Trust) described some of the ways in which the National Trust is using its diverse portfolio of historic sites as a testbed for innovative local responses to climate change. However, mitigation on its own will not be enough to solve all of the problems facing the country's inheritance of historic buildings. Storms and exceptionally heavy rainfall are making unprecedented demands on original drainage systems. To cope with these pressures there is sometimes no alternative but to adapt existing water management systems to meet the much greater volumes of water that are likely to be thrown at them in future. For this to happen, all those involved in making decisions about the adaptation of historic buildings will need to have the confidence to use the inherent flexibility in the current system to mediate creative and sensitive reconciliations between the competing demands of conservation and climate change.

Moving on to the 4.7 million pre-1918 buildings that make up a fifth of the nation's housing stock, **Chris Sanders** (Glasgow Caledonian University) described the dilemma of an enormous inheritance of environmental capital that would take many decades to replace, even if we should wish to do such a thing. In particular, a widely held assumption that houses built in the 1960s to 1980s are in every instance more efficient than their older counterparts now needs to be challenged. The system of SAP ratings used by government to measure energy-performance argues that older buildings are intrinsically less

Even the most important historical buildings can be amenable to sensitive adaption. Photo-voltaic panels installed on the hidden roof of the Grade I St James's Church in Piccadilly.

efficient, but real-life empirical studies consistently show that better insulation saves less energy than the SAP models predict. This is partly due to the faulty way the models predict the behaviours of real buildings, but it also has a great deal to do with how people actually *use* their homes.

Continuing on this theme, **David Shipworth** (Reading University) described some of the analytical methods being developed to assess the whole-life energy costs of buildings – in other words an evidence-base that takes account not only of the environmental costs of their original construction, but of their subsequent occupancy, adaptation and eventual demolition. We also need to remember that traditional methods of SAP rating take no account of the embodied energy locked into a building, or of the additional energy needed to adapt or demolish it.

At the heart of his argument is the challenging fact that in the decades in which the SAP ratings of buildings have been steadily rising, so too has their actual energy usage. Though more research is still needed, this again seems to reflect how people have been using their living spaces in a world of cheap domestic energy. Instead of applying precious heat selectively to particular rooms at certain times of day, as was the practice in the past, they have adapted to a more lavish open-plan style of living in which every room in the house is heated day and night to the same high temperature.

'The historical diversity of energy practices is the gene-pool from which new ways of operating our buildings can evolve – we need to record them and creatively adapt them to the present.'
David Shipworth, University of Reading

The creation of consensus

Having listened to the provocative messages of the speakers, delegates were invited to map out their own scenarios for the way in which our built environment will be affected by the challenges of climate change. Encouraged to look ahead to 2038, they were first asked to imagine the state of our towns and cities assuming that for thirty years it had been 'business as usual', with no strong commitment to adaptation by government or industry. Almost without exception the picture was of urban degradation, energy poverty and an overall decay in the condition of the built environment, especially the newer building stock. Little of this was due to the direct local impacts of climate change but was instead the consequence of social and economic breakdown at a much wider national and international scale.

When asked to imagine what those same urban and rural environments would be like if all the desirable adaptations had been made, the

Delegates in the Inventing the Future summit working together to envisage how the built environment can contribute to the battle against climate change.
© Mac Andrews, Quantum Steps

vision was once again quite universal but this time much more up-beat: an enhanced public domain with reduced traffic, stronger local community hubs, local energy generation and above all a well-maintained stock of traditional buildings making a positive contribution to a more sustainable future.

Having completed this first exercise in looking ahead, the delegates then moved on to start mapping out some of the practical next steps that will need to be taken in the months ahead. This summit was never meant to be about instant solutions. On the contrary its purpose was to allow the participants to gain a better collective understanding of what we know – and just as importantly do not yet know – about the primary and secondary impacts of climate change on the built environment. Above all, it was to be about building a consensus of opinion – not only concerning the direction of the road ahead, but the part that government agencies, industry and the voluntary sector would each need to play in its successful navigation.

As everyone packed their bags it was clear that the summit had already begun to reach some important shared conclusions. Amongst the big messages that this particular delegate took home with him were:

- There is now positive evidence that traditional buildings and materials *do* make energy sense
- Traditional buildings can also last a *very* long time – provided they are properly maintained and adapted
- The historic environment also has vital things to teach the future, not only about building more *densely* but more *sustainably*
- Theoretical SAP ratings are distorting the picture – it's *people* not *houses* that waste energy
- Engaging people and communities is vital, it's not just about *regulation* but *participation*
- Playing to the different strengths of the academic, public and voluntary sectors is also vital – partnership is not an *option*, it's *essential*
- Time is *not* on our side – to catch up we urgently need a prioritised programme of technical research and wider engagement.

Over the next couple of months, English Heritage will be assimilating the mass of information that was debated over the two days of the summit. They will use this material to produce a series of proposed next steps that will be widely circulated to everyone who participated and all other interested parties.

Key messages and more detailed feedback from the summit will be published on English Heritage's website (**www.english-heritage.org.uk/climatechange**). English Heritage will also use the insights from the summit to inform its other climate change initiatives such as its major Hearth and Home research project (see p 36). At the same time, it will make sure that the summit's immensely valuable findings are fed back to government at the highest possible level. ■

Carrying on the theme of the summit, a new *Climate Change and Your Home* web portal will help owners of traditionally constructed homes to understand more about the impacts of climate change and ways to save energy.

Learning to Adapt

There are many ways in which the historic environment can respond to climate change – from local mitigation to international adaptation strategies.

Almost every part of the historic environment sector is now actively responding to the challenge of a changing climate. At one level the initiatives are about collecting and sharing evidence (Holborow pp 26–9; Drewe, pp 29–30 and 36); at another it is about developing adaptive strategies and policies, whether regionally, nationally or internationally (Owen-John pp 30–1; Young pp 37–8; Coxen p 39). At a third level it is about practical mitigation and adaptation measures down at the grass roots (Jarman pp 31–2; Parker pp 32–3; Bowler pp 33–4; Rich pp 34–5 Cole pp 38–9).

Cutting down on carbon from the public sector estate

Will Holborow
Head of the Government Historic Estates Unit, English Heritage

The government has set ambitious targets for improving the energy efficiency of its own estate. As a result, managers of government property are faced with complex judgements about how best to improve the energy efficiency of their buildings. When deciding between retention of an existing building and replacement with a new one, any comparison of energy use has to take account of a number of variables such as the embodied energy of the existing building, future energy prices and pay-back periods for investment. Where the building is to be retained, there will be a range of options for energy-saving measures of varying cost and effectiveness. If that building is also of historic value, and possibly protected through listing, the benefits of potential energy-saving measures must be considered in terms of their impact on the character and special interest of the building. Many proposals for alterations to historic buildings can be expected over the next few years, related to conserving or generating energy; in assessing them, English Heritage will be seeking to take a consistent approach based on its newly agreed *Conservation Principles* (English Heritage 2008) and the range of new guidance notes referred to elsewhere in this *Bulletin*.

In response to this issue, English Heritage's Government Historic Estates Unit (GHEU) held its annual conservation seminar in October 2007 on the theme of 'Cutting down on carbon: improving the energy efficiency of historic buildings'. The seminar was held at the Building Research Establishment (BRE) site at Garston, near Watford. More than 90 delegates attended the one-day seminar, representing a wide range of government departments and agencies, plus a variety of other public bodies. The presentations given by expert speakers highlighted the challenges, initiatives and opportunities that relate to upgrading the performance of public buildings. A resumé of the presentations is available from GHEU's page on the HELM website (**www.helm.org.uk/gheu**).

Challenges

In June 2006, the Prime Minister launched new targets for sustainable operations on the government estate. The targets on energy require that the central-government office estate be carbon neutral by 2012. By 2020, departments are expected to reduce carbon emissions by 30 per cent while increasing energy efficiency by 30 per cent, relative to 1999/2000 levels. These are ambitious targets that will require departments to exceed the current standards required under Part L

Hanham Hall, a Grade II-listed former hospital in Bristol, is a site identified under the Carbon Challenge, being run by English Partnerships. The listed building will be adapted for community use and new zero-carbon housing built in the grounds, using a variety of sustainable building techniques.

HM Treasury, Whitehall – the west courtyard. The refurbishment in 2002–4 of the Treasury offices in Whitehall achieved significant environmental benefits; the west end of the building (listed Grade II*) achieved a BREEAM (Building Research Establishment Environmental Assessment Method) rating of excellent through the enhancement of the existing building's natural ventilation combined with modern mechanical and electrical services.
Nigel Young
© Foster and Partners

of the *Building Regulations*. From October 2008 public buildngs with a floor area greater than 1000 sq m will be required to present Display Energy Certificates (DECs) showing actual energy consumption and an operational rating from A to G.

Demolish or rebuild?

The high thermal mass of traditional buildings has environmental benefits in reducing the demand for heating and cooling. The construction of existing buildings also represents embodied energy. The fact that 24 per cent of all UK waste is building waste calls into question some of the supposed advantages of new-build over refurbishment. A study by BRE of the refurbishment of offices compared with new-build has found that the refurbishment option is always environmentally better than redevelopment provided that air-conditioning is not used, and is also cheaper. BRE has recently carried out some work on carbon emissions arising from operational and embodied impacts using Life Cycle Assessment, an analysis of the environmental impact of construction and occupation that considers pollution and toxicity as well as energy consumption.

In the domestic sector, there has already been a considerable debate about the need to demolish older housing. The 40 per cent house project (**www.40percent.org.uk**), which excluded buildings in conservation areas, anticipates a substantial increase in rates of demolition in order to achieve a 60 per cent saving in CO_2 emissions by 2050. However, any proposals for the demolition of housing must take into account concerns in relation to community and heritage values, as highlighted by a recent National Audit Office report on the Pathfinder housing market renewal schemes (**www.nao.org.uk/pn/07-08/070820.htm**).

Understanding energy performance

The starting point for any programme of works to improve energy efficiency must be a detailed understanding of the building's construction,

Knutsford Sessions House. Dating from 1817 and listed Grade II*, it remains in use as a Crown court. The building's high thermal mass and natural ventilation system are important factors in constraining its energy use.
© Will Holborow

modification and use. This should be accompanied by an analysis of current energy use and environmental performance. A range of techniques is available to assist in this. A fan pressurisation test (compulsory for new-build under Part L of the Building Regulations) can be used to identify air leakage positions in existing buildings; images taken by a thermographic camera can identify cold bridging; data loggers can track changes in humidity and temperature in a range of rooms throughout the building. Analysis of use patterns, surveys of user experiences and comparison with similar buildings can all add valuable information. Lastly, the thermal performance of the upgraded building should be monitored to test the effectiveness of the measures taken.

Measures

Small changes can sometimes result in improved performance: altering use patterns, correcting any maintenance backlog (eg cleaning windows and light fittings), repairing windows and doors, improving controls (eg programmable thermostats, thermostatic radiator valves), upgrading artificial lighting and portable appliances. Where there is a complex of buildings, a combined heat and power system (CHP) may yield energy savings.

Satisfying current standards requires replacement glazing to be double-glazed and of low-emissivity glass within frames that resist cold bridging, though repairs to existing windows are not controlled. Historic Scotland (with Glasgow Caledonian University) is undertaking research into the performance and potential upgrading of traditional sash windows; English Heritage plans to collaborate in this work.

Demonstration projects

There are still relatively few well-documented case studies for non-domestic refurbishment projects. However there are two current demonstration projects that are concerned with the energy-efficient re-use of existing buildings. One of these is the refurbishment of the stable block on BRE's site at Garston, an unlisted 19th-century building. The other is Hanham Hall, Bristol, a Grade II-listed former hospital building which has been selected by English Partnerships as one of its Carbon Challenge sites.

The Court Service estate

The Court Service has made a detailed study of the energy usage and efficiency of a cross-section of law courts and associated buildings that seems to confirm the inherent energy efficiency of traditionally constructed pre-war public buildings. There are about 800 buildings in the Court Service portfolio, including office buildings and judges' lodgings as well as courts; 20 per cent of these are listed. The study looked in detail at 33 per cent of the estate, chosen to reflect the overall portfolio in terms of age, size, type and usage. Annual energy use was analysed and the data were then sorted by various different categories.

Bristol Guildhall. Dating from 1843 and listed Grade II, this is occupied as a county court. A study of court buildings has shown that those built before 1900 have a lower average energy use (216 kWh/m^2 per annum) than those built between 1900 and 2000.

The results confirmed that the construction type indicated by date band was of primary importance in affecting energy efficiency. Pre-1900 buildings were generally the most energy-efficient due to their high-mass construction, with natural lighting and ventilation. Their performance was approached only by those of the 1990s and 2000s. Those of the 1940s and 1950s were by far the worst group for energy efficiency, and are also the most difficult to upgrade. Buildings dating from 1900 to 1939 suffer poorer energy efficiency as a result of lighter construction techniques, and can probably be improved with additional insulation. Those dating from 1970 to 1989 give similarly poor results and tend to rely heavily on artificial lighting, heating and air-conditioning with deep floor plans. Those of the 1960s are almost as poor as those of the 1940s and 1950s. Based on these results, recommendations have been made that pre-1900 buildings should be prioritised for retention, and their energy efficiency improved through a range of low-intervention measures. The report recommends that poorly performing buildings of the 1940s, 1950s and 1960s should be prioritised for disposal.

Conclusions

A balanced and well-informed approach is essential to upgrading historic buildings to reduce energy consumption. Before decisions are taken about physical interventions, it is necessary to understand both the environmental performance and historic and architectural significance of a building. For large public and institutional property owners, there are major advantages in applying this analysis consistently across a whole estate. Once this analysis has been undertaken, a graduated approach is recommended to energy-saving measures, beginning by improving energy management before moving on to physical interventions. The energy benefits of alternative options should be weighed carefully against their impact on the historic character of the building and its setting. Ill-considered interventions can have unintended consequences on environmental performance, as well as providing a poor return on investment. Nonetheless, significant energy savings can be made without damaging alterations. Further research and demonstration projects are urgently needed to improve our understanding of how the energy performance of existing buildings can best be improved.

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Measuring English Heritage's carbon footprint

David Drewe

Head of Building Services, English Heritage

English Heritage has been working with the Carbon Trust since 2003 to benchmark its energy usage. The first project, which was fully funded by the Carbon Trust, looked at English Heritage's regional offices and benchmarked their energy usage against government guidelines. The project produced benchmarks for each of the regional offices using the government's *Energy Consumption Guide 19 – Energy Use in Offices* (**www.thecarbontrust.co.uk/publications**).

In 2005 a second project, which was match-funded by the Carbon Trust, was set up to look at the 400 historic properties in English Heritage's care. The majority of these are either listed buildings or scheduled ancient monuments, for which there are no published benchmarks. The aim of this project, therefore, was to develop a set of benchmarks that could be used not only by English Heritage but others as well. In addition to looking at the estate in general, 18 of English Heritage's top energy-using sites were examined in greater detail and a set of performance indicators was developed that could be used to reduce energy consumption at these sites.

Over the next three years English Heritage

Measuring English Heritage's carbon-footprint: the Swindon home of the National Monuments Record combines the traditionally constructed 19th-century General Office of the Great Western Railway with a sophisticated climatically controlled archive store built in 1994.

will be assessing its environmental/carbon footprint. The first phase of this project is already under way and involves a scoping study to identify the footprint of all English Heritage activities and operations. It will then be possible to consider whether and by how much the footprint can be reduced.

English Heritage is also taking part in a wider DCMS climate change research project, which involves 18 of DCMS's sponsored organisations. The project aims to gauge how current information about climate change is likely to impact on the future range of DCMS's activities, and offers an opportunity to shape policy development through a mutual exchange of views and experiences. The project has three strands:

- Gathering evidence about the work that the 18 organisations are already doing to mitigate the impact of climate change in their sectors and support public understanding of the challenge. Illustrative case studies will then be showcased on the DCMS website to identify good practice and key challenges, aimed at key policy-makers and the wider public.
- Undertaking an academic literature review of the available published evidence of the impact of climate change on cultural and sporting assets. This will highlight gaps in knowledge and guide DCMS's future action.
- Measuring DCMS's carbon footprint to establish a baseline against which future reductions can be measured. This strand anticipates likely future requirements from the Treasury to measure the carbon footprints of all public-sector buildings. ■

Going with the wind

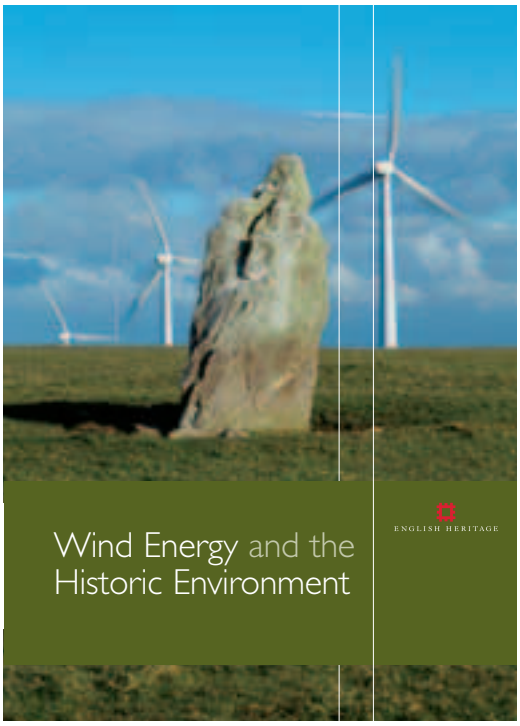
Henry Owen-John
Regional Director, North West, English Heritage

English Heritage published guidance on wind energy and the historic environment in 2005 (English Heritage 2005) to assist developers and planners in dealing with the implications of such schemes for the historic environment. The guidance makes clear that English Heritage supports measures to reduce fuel consumption, increase energy efficiency and exploit renewable energy sources. There is a presumption in favour of renewable energy projects unless the benefits of a scheme are outweighed by negative impacts on the historic environment.

While the balance of advantage can be assessed only in individual cases, there is a clear need to develop consistent approaches to carrying out such an assessment. The 2005 guidance gives some advice on this, but a more detailed methodology is needed. The coincidence of a number of proposed wind farms with Hadrian's Wall, the Outstanding Universal Value (OUV) of which is recognised in its World Heritage Site status, requires the historic environment sector to develop this methodology. These approaches may have wider applicability, especially in relation to the forthcoming Heritage Protection reforms.

It is important that sufficient information is available from the developer to allow impacts to be assessed. Those which apply to direct physical impact on archaeological remains can be dealt with in the usual way set out in *PPG16*, but the assessment of the effects on the setting of archaeological sites and historic buildings and landscapes is more complex. The best starting point is for the areas from which the wind farm would be visible

Looking north from the Roman fort at Maryport on the west coast of Cumbria. Roman military installations, including a mile fort on Swathy Hill at the right of the picture follow the line of the coast. The introduction of wind turbines into this view would affect the ability to appreciate the frontier landscape, whereas wind farms located inland would have a lesser impact.
© English Heritage



English Heritage supports the generation of energy from renewable sources, provided that the associated equipment and infrastructure do not significantly compromise the historic environment.
© English Heritage

to be mapped and overlaid on the maps derived from the Historic Environment Record and characterisation work. The potential cumulative impact of further proposals for the wider area also needs to be considered. There should not, however, be a presumption that, because wind turbines are visible from an historic asset or intrude on views of it, there should be an objection to the proposal.

In the case of Hadrian's Wall the key issue is to assess the impact of the proposals on OUV. This is focused on the wall as part of the second-largest imperial frontier in world history, and one where the military and geopolitical strategy that created it, and its development over more than 300 years, can still be read from the physical evidence in the landscape. On the west coast of Cumbria the outlook northwards along the coast, and across the Solway to Scotland from the Roman fort at Maryport, provides a readily understandable view of the frontier landscape. Wind-farm proposals inland from these sightlines are less likely to impinge to a significant extent on the ability to appreciate the frontier, even though some turbines will be easily visible. Conversely wind farms that interrupt these sight lines, or strongly distract views between the Roman defences, may have a detrimental impact on the OUV of the World Heritage Site, and should be resisted.

It is approaches such as this that will be needed to assess the impact of wind farms on the historic environment in individual cases, moving away from the 'because it's there' argument to a more developed measurement of impact on significance. It will then be for local planning authorities, and in some cases the Secretary of State, to measure the renewable energy benefits against historic environment factors and reach an informed decision. ■

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Mitigating the National Trust

Rob Jarman
Head of Sustainability and Environmental Practices, National Trust

The National Trust has recognised the importance of climate change to its interests since the early 1990s, when it started to understand the very serious implications of accelerating sea-level rise for its extensive and important coastal ownership. The Trust's concern rapidly extended to cover the impacts of extreme climatic events such as floods and droughts, heat-waves and cold, and storms, on all its interests.

The Trust knows that it must reduce its own contributions of greenhouse gases while also adapting to unstoppable climate change. It is too profligate in its use of energy, especially of electricity and of oil for heating, and takes-short term economic decisions about investment in

Conservation is best achieved by appropriate re-use. Gibson Mill, West Yorkshire, is a self-sufficient 'power station' – using solar PV (left) and hot water panels, log stoves (right) and small hydro to provide all year round electricity and heat for the National Trust's visitor cafe, community rooms and education centre.

energy efficiency or renewable energy.

In 1998 the Trust decided that it must manage its land and buildings to reduce greenhouse-gas emissions – in ways that are adaptable to climate change, that are robust and reversible. It set three key objectives – first, managing its land as a carbon bank; second, reducing use of energy across the whole Trust; third, developing renewable energy sources on its estates to displace fossil fuels.

Managing land for carbon should be good for conservation – it means maintaining peatlands as wetlands, preventing erosion of uplands, preventing moorland fires and sustaining active bogs where carbon can be sequestered. It also means protecting lowland soils and 'growing' their content of organic matter, through changed land use and better soil management. The historic environment should be a major beneficiary of such mitigation work, although land management for carbon may also pose some conflicts of interest – for example, woodland for wood products; or land use for biofuels. The Trust aims to integrate conservation and environmental objectives and manage land for multiple interests.

Reducing its use of energy is the Number 1 priority in the Trust's Energy Policy. Targets have been set for electricity and oil/gas savings that depend on insulation and draught-proofing and changes to lighting and heating systems. In historic buildings energy-efficiency measures are being implemented that respect conservation requirements for fabric and aesthetic interests and so have to use materials and methods that cost more – such as insulation materials made from sheepswool or hemp/flax instead of rockwool; or bespoke secondary glazing and draught-proofing systems; or appropriate low-energy lamps with reduced UV outputs.

Finally, the Trust aims to radically increase the generation of renewable energy on its estates – it has already installed hydro, solar, heat-pump and wood-fuel systems on enough sites to know what works and also what meets natural and historic environment requirements. Its project at Gibson Mill near Hebden Bridge, where a mill has been refurbished for education and visitor use in such a way as to be totally self-sufficient in energy (hydro, solar, woodfuel), and where solar panels have been installed on a Grade II listed building, demonstrates how to combine renewables with high conservation standards. The Trust has just gained Listed Building Consent for solar panels (PV) on the roof of Dunster Castle (a Grade I listed building) in West Somerset. Its task now is to find the resources to make the Trust self-sufficient in renewable energy! Help!

At Aske Hall, near Richmond in North Yorkshire, wood-chip boilers are being progressively installed as more efficient and environmentally friendly replacements for traditional heating systems. 1: Aske Hall stableyard, 2: wood-chip boiler, 3: traditional building used as a hopper for the wood chip. © Historic Houses Association

Powering historic houses

Robert Parker
Technical Adviser, Historic Houses Association

In a quiet revolution many of the 1,500 historic houses, castles, parks and gardens that the Historic Houses Association (HHA) represents have for years embraced sources of renewable energy and endeavoured to reduce their carbon emissions. Hitherto financial considerations have been the prime motivation – to control the rising costs of lighting and heating houses that in many circumstances are both private homes and significant tourist enterprises. For even a relatively

small historic mansion of 2,000 sq m the rationale of heating rooms that are intermittently occupied, but display important art collections, has always needed to be carefully considered. Lighting, also, can be a difficult issue in rooms that have chandeliers with multiple bulbs that collectively may amount to more than 1kw, equivalent to a small heater. In what might be regarded as a step back to the past the use of traditional blinds and shutters continues to be important. So the private owner already has had the motivation to reduce carbon emissions; but new government measures to combat climate change have introduced new challenges.

While the HHA is concerned that the introduction of energy performance certificates (EPCs) does not adequately recognise the characteristics and needs of older buildings, the principles they enshrine of energy efficiency are sound, even if difficult to implement in a listed building. Measures to improve the insulation of walls, roof and floors in an historic house may prove unrealistic; but the efficiency of the current heating system can often be improved dramatically and a simple change to energy-saving light bulbs will make a positive contribution. However, such simple measures also raise problems. For example, the sheer scale of replacing a pre-war central-heating system with modern micro-pipework is daunting for many private owners, apart from the disruption to the fabric. Technology has yet to catch up with a sympathetic design of energy-saving light bulb for traditional fittings, or one that produces an appropriate intensity and colour of light.

HHA members have been leaders in the introduction of renewable sources of energy.

Dalehead Church (Bradford Diocese). The chapel and Heritage Centre are powered by wind turbine. The graveyard is a Biological Heritage Site with more than 130 species of upland meadow plants.
© Mr John Parry

A wind turbine was introduced at Hoghton Tower, Blackburn in the 1980s, and installations of solar panels, ground source heat pumps and micro hydroelectric schemes are becoming increasingly common. However it is the installation of wood-chip boilers that has captured the particular interest of many private owners. For example, at Aske Hall, Richmond, a 150kw boiler was installed in the conversion of the Oliver buildings to supply heating to offices. The success of this scheme has resulted in a similar boiler being installed to replace a traditional system in the main stable yard for 1900 sq m of commercial office units and a further boiler is planned for Aske Hall itself.

The HHA is in a unique position to capture the good or bad experiences of its members as they introduce energy-efficiency measures and then to disseminate that practical knowledge to other parts of the heritage sector. ■

Thinking nationally; acting locally: the Church of England and climate change

Stephen Bowler
Senior Policy Officer, English Heritage

Q: What, besides Sunday trading, does the Church of England now share with the major supermarket chains?
A: The size of its carbon footprint (around 1.3 million tonnes pa).

The Church of England's engagement with the environmental agenda dates to the mid-1980s, though its current policy, in *Sharing God's Planet*, was approved by the General Synod in July 2005 (**www.shrinkingthefootprint.cofe.anglican.org**).

The Church has its own emphasis. Famously the Bishop of London suggested that 'making selfish choices such as flying on holiday or buying a large car are a symptom of sin'; the worldwide Anglican Communion defined one mark of the Church's mission as being 'to strive to safeguard the integrity of creation and to sustain the life of the earth'. Not the usual drivers for change.

The national Church approach reflected this by aiming at raising awareness and encouraging local action among church-going members – leading others by example. It had some success. A recent survey of churchgoers for the Marches Energy Agency (MEA) found that 94 per cent were concerned or highly concerned about the environment; 85 per cent had switched to energy-saving lightbulbs. But this approach did not provide benchmarks for energy use, assessment of

the likely impact of climate change or the savings increasingly expected of responsible organisations. An *institutional* approach was also needed.

In June 2006 Shrinking the Footprint (StF) was launched, aiming to bring about significant change in Church activities, structures and processes to reduce carbon emissions to 40 per cent of current levels by 2050. It supports the good work already going on but also focuses on the 'business' of the many bodies that make up the 'official' Church at every level. As well as promoting simple steps to improve energy efficiency it aims to drive strategic research and development, often in collaboration with traditional partners such as English Heritage and Defra, or with new partners such as the Carbon Trust and the Energy Saving Trust.

The scale and range of the Church of England's business, and its devolved, substantially voluntarily-funded structures and governance make responding to climate change especially challenging. Church buildings are particularly vulnerable.

Around 25 per cent of the Church's 1.3 million-tonne footprint relates to its 16,200 churches, 41 cathedrals and numerous halls (the rest comes from by offices, clergy houses and schools). Given that 80 per cent of those buildings are listed, 35 per cent of them at Grade I, this is a significant responsibility, and one divided between 13,000 local parishes.

Local volunteers raise £107 million each year to maintain their churches (to which add £8.5 million of metal thefts in 2007), but a further £925 million of repairs will be needed in the next five years (2005–6 English Heritage/Church of England *Fabric Needs Survey*). Extreme weather events are a substantial threat; rivers in flood can break more than one bank. Similarly, many churches struggle with energy-efficiency steps such as changing boilers or improving insulation – assuming they are acceptable in a listed building – Dalehead's example (see photo) is beyond most.

If the financial and technical barriers are substantial, there is a dearth of advice. Most churches are 'hard to treat' buildings but many of the usual sources of guidance, such as Energy Advice Centres, are unble to support them because they do not easily fit into domestic or commercial categories.

The StF approach has been to work with the Carbon Trust, and consultants Faber Maunsell, on its Carbon Management Programme (CMP). A national audit gathered energy-use data for 2005 from over 25 per cent of parish churches. This benchmark data contributed to the first scoping phase of the CMP, now being refined with a research programme looking at 7 cathedrals and 24 parish churches.

The CMP is now in its implementation phase when specific steps which the Church can take to reduce its footprint are being identified. Partnerships within the Church and with bodies such as English Heritage and the amenity societies will be important. New partnerships may be crucial. A successful example was Cutting the Carbon, a partnership with the Energy Saving Trust, Ecclesiastical Insurance/Churches Purchasing Scheme and Good Energy. It was launched as part of last year's National Energy Saving Week and will offer energy-efficiency guidance and products and a green energy affiliation scheme to parishes. Many more of these will be needed to safeguard churches against the challenges which climate change will bring in future years.

Heelis: sustainable offices for conservation

Geoff Rich
Feilden Clegg Bradley Studios

Sustainability is at the heart of the National Trust's conservation mission and the design brief to Feilden Clegg Bradley Studios (FCB) for the Trust's new HQ building was to develop the most sustainable office building possible within the available budget. Opened in 2005, the Trust's new central office – named 'Heelis' – demonstrates that exemplary sustainable commercial buildings can be built economically – even for historically sensitive sites.

Heelis is located on the former Great Western Railway Works site in Swindon. The site is tentatively proposed for designation as a World Heritage Site and the new building sits amidst listed 19th-century railway sheds. The National Trust's requirement was for a 'frugal, appropriate and inspiring building' and the design seeks to break new ground in green office design while providing an attractive new amenity for both staff and members of the public. It also aims to make a significant contribution to the regeneration of its historic site.

Constructed at the heart of the former Great Western Railway workshop complex in Swindon, the National Trust's new 'Heelis' HQ building demonstrates that exemplary sustainable commercial buildings can be built economically – even for historically sensitive sites like this.
© Feilden Clegg Bradley Studios

Green design

The National Trust's brief to FCB was to consider sustainability measures for which a 'payback' period of less than 20 years can be demonstrated. The capital and running costs of various options were explored at early design stages and the following were agreed for incorporation within the design:

- photovoltaic panels
- enhanced thermal insulation
- wintertime mechanical ventilation with heat recovery
- a lighting control system
- sustainable urban drainage
- lime mortar for external brickwork.

Heelis is designed to harness the maximum amount of useful natural energy and to operate with very efficient and controllable mechanical systems. It is a design philosophy that extends from the architectural concept through to the fit-out. For example, the interior-space planning rules included limitations on furniture heights to maximise natural lighting, and even the orientation of furniture layouts is designed to maximise natural air flows for ventilation!

Arrays of photovoltaic panels on the roof of the National Trust's 'Heelis' building are designed to meet 36 per cent of the building's energy needs.
© Feilden Clegg Bradley Studios

The roof

A major part of the design is the roof design, which incorporates some key features that contribute to the environmental performance of the building. The roof design is a reinterpretation of the traditional ridge-and-furrow roof form of the surrounding former railway sheds that has been carefully adapted to improve its efficiency. The northern slopes of the new roof help to provide high levels of glare-free natural light, which is sufficient light for 85 per cent of working hours. On the southern slopes, a large area contains photovoltaic panels, which produce 36 per cent of the building's energy demand. Also within the roof design are 'snouts', which enable a simple natural roof-light ventilation strategy to operate within the building below whatever the weather.

Traditional materials

As part of the design, a range of traditional materials and techniques is employed. The external brick walls are built using pigmented lime mortar both to minimise cement usage and to facilitate potential future recycling of the bricks at the end of the building's life. Within the building, timber from the National Trust's own forests has been selected to line interior rooms and for the new furniture. Even the décor draws on the Trust's traditional and renewable resources, with wool from Herdwick sheep used to manufacture carpet tiles used throughout the office and meeting-room areas, which it is hoped will contribute to developing a viable market for the wool.

Green travel

The National Trust's green plan for the building extends beyond the building too. A key reason for the choice of the site was its close proximity to the railway station, which is a 10–15 minute walk away, and the site also benefits from excellent bus links. Car-parking provision on site is therefore lower than normal, with spaces prioritised for those 'car sharing'. Staff who live within 5km of Heelis are encouraged to walk or cycle, or use public transport and the National Trust offers staff walking and cycling maps, bus and train timetables, and season-ticket loans. Showers and lockers are also provided in the building for the use of cyclists, walkers and runners.

Incorporation of these design ideas has helped

the National Trust's Central Office to achieve an 'excellent' BREEAM rating. It won both the Civic Trust's Sustainability Award and the RIBA Sustainability Award in 2006, and the British Council for Offices' Innovation Award.

Hearth and Home project

David Drewe
Head of Building Services, English Heritage

Reducing the consumption of energy is seen as one of the main ways that climate change can be tackled. Domestic buildings account for a third of all energy use (Dti 2002) and of the estimated 21 million dwellings in England, more than 4 million were built before 1919 (CLG 2003). With climate change now high on the government's agenda, a significant proportion of these older buildings are threatened with demolition or drastic alteration because such dwellings are seen as inherently inefficient. However, many of the assumptions and models currently used to judge their performance were devised more than 20 years ago and there have been significant changes since then. In addition, the models were devised on the basis of modern methods of construction so assume, for instance, that buildings are constructed with cavity walls whereas in fact an estimated 3.6 million of pre-1919 homes are of non-cavity-wall construction (CLG 2003).

English Heritage is therefore developing Hearth and Home, an ambitious research project that will monitor the energy usage of real Victorian houses, lived in by ordinary people. This information will then be used to evaluate the cost-effectiveness of energy-saving options and ultimately to provide guidance on how to reduce domestic fuel usage and carbon emissions. The project will look at how easy it is to make improvements and the cost and energy effectiveness of such improvements. It will also look at how people use energy and how changes to their lifestyles can simultaneously improve their comfort and reduce their carbon footprints.

English Heritage will make sure that changes to the buildings do not harm the appearance or character of dwellings, unless there is a particular research gain from doing otherwise. The purpose of the project is to show which improvements or combination of improvements provides the most benefit. In the first phase of the project a full year will be spent monitoring the current energy usage and lifestyle choices of the sample households. This will determine the baseline against which the effectiveness of any subsequent improvements

Harehills, Leeds. Britain's stock of 19th-century terraced housing contains a vast amount of embedded environmental capital – an asset we can ill-afford to waste. English Heritage's new Hearth and Home project is designed to find out how this vital component of the nation's housing stock can be made more energy-efficient.

can be judged. In the second phase a number of improvements will be made to each building's fabric, services and equipment, which will then be monitored for a further year to evaluate the cost and energy effectiveness of the improvements against the baseline. In a third and final phase a sub-sample of the houses will have further improvements made to them, including some that involve the application of more sophisticated technology.

Although monitoring will continue after the third phase, the data collected in the initial phases will be used to provide an initial evaluation of the best combination of options for increasing the energy efficiency of the nation's older housing stock. In part these recommendations will be about technical ways of reducing energy consumption, making the best use of materials and minimising the production of waste production, but they will also take account of the developing perceptions of the houses' occupants to more sustainable ways of living.

Once the project is up and running its progress and findings will be regularly reported via English Heritage's website. Meanwhile, for further details please email: conservation@english-heritage.org.uk

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Climate change and the international cultural heritage

Christopher Young
Head of World Heritage and International Policy, English Heritage

The impacts of climate change on the historic environment cannot be dealt with solely on a national or local basis. Just as the causes and impacts of climate change affect the whole world, so the effects on heritage can be equally wide. These could include flooding, the spread of pests, impacts on building types and the decay of archaeological deposits. International cooperation to investigate the causes and effects of climate change and to develop methods of adaptation and mitigation is urgently needed. So far, however, the potential impact on cultural heritage has been little recognised. The 2007 IPCC report, the key information document for policy-makers worldwide, contains no reference at all to the historic environment (IPCC 2007d, see p 41).

Despite this, over the last two to three years there has been increased activity, which hopefully may lead to future action at the international level. At the European level, the EU-funded Noah's Ark project has for the first time provided firm evidence of the impacts of climate change across a large part of the continent (**www.noahsark.isac.cnr.it**). ICOMOS (International Council on Monuments and Sites) decided in 2006 to develop a three-year project to investigate and document the impacts of climate change on cultural heritage. The first fruit of this was a workshop on adaptation to climate change in Pretoria last October. The next ICOMOS Heritage @ Risk publication will contain a dozen case studies on the impact of climate change.

Possibly the most significant action, because it is taken by an inter-governmental body, is the involvement of the UNESCO World Heritage Committee with climate change. This was triggered in 2004 by petitions on the impact of climate change on four natural World Heritage Sites. Partly at the suggestion of the UK government, this interest was extended to consider the effects on cultural heritage also. An international expert meeting, funded by the UK government and by the United Nations Foundation, was held in Paris in March 2006. UK experts prepared much of the cultural aspect of the background paper presented to that meeting (see Cassar pp 7–11).

One outcome of that meeting was two publications – a volume of proceedings, and a volume of case studies (World Heritage Centre 2007; Colette 2007). The case studies cover both natural and cultural World Heritage properties, including archaeological and urban sites. A survey of the member states of the World Heritage Convention identified 46 cultural World Heritage Sites considered by governments to be already affected by climate change. Types of threat included

Terezin, Czech Republic. In 2002 the worst floods in more than 200 years wreaked havoc among the historic towns and monuments of central Europe, including this memorial to the 150,000 Jews who were interned in the Terezin ghetto.

storms, increased rainfall, flooding, sea-level rise, erosion, temperature increase, drought and desertification, thus showing that climate change can affect places in many different ways.

Following on from the expert meeting, the UNESCO World Heritage Committee has adopted a strategy for dealing with climate change. This focuses on the needs for international cooperation as well as for individual states and sites to incorporate consideration of climate change at all stages of the World Heritage process, including the nomination of sites, development and implementation of their management plans, monitoring and reporting, and risk preparedness. Future editions of the World Heritage Operational Guidelines will include specific reference to these needs. Above all, the strategy and the associated Committee decisions identify the need to carry out research to provide firm evidence based on scientific research to ensure that the impact of climate change on heritage, both cultural and natural, is taken seriously in the future. There was also considerable emphasis on the need to use World Heritage Sites, which are generally well known, to raise awareness of the impacts of climate change on heritage.

These efforts show that awareness of the impact of climate change on heritage is growing internationally. However, there is still a lack of firm evidence based on sound science as to how climate change is affecting, and will impact on, the historic environment. This is demonstrated by the failure to get any reference to cultural heritage into the 2007 IPCC report. The highest priority internationally over the next few years is to develop that evidence base so that IPCC and the policy-makers who follow its advice take seriously the actual and potential impact of climate change on cultural heritage. The initiatives outlined above should be a valuable contribution to this process. ■

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A stitch in time

Sue Cole
Senior Policy Officer, English Heritage

Over the last 20 years, cultural heritage in the UK has been battered by hurricanes, floods and even earthquakes, not to mention fire, vandalism and terrorism. Public attention is caught by the great disasters – the Windsor Castle or Uppark fires, the floods of summer 2007 – with comments focusing on what has been lost and why was it not prevented. Hindsight is a wonderful thing.

The flooding of Rose Cottage and 60 other buildings at Ironbridge in 2007 demonstrates the vital need for regular maintenance of drainage systems in the face of climate change.

But with a little preparation it is possible to ensure that an emergency does not turn into a disaster. The key words here are preparedness, planning, training and 'don't panic'. Disaster or emergency planning (sometimes called business continuity planning) is now mandatory for most companies; the Civil Contingencies Act 2004 imposes a duty on local authorities to give business continuity advice to their local communities. Museums have to prepare and register formal emergency plans and most libraries and archives have long-established emergency procedures, but such contingency planning is relatively new to the historic environment world.

Emergency planning breaks down into four basic stages – preparedness, reaction, recovery and review.

Preparedness starts with the identification of the need for an emergency plan. In large organisations it is essential for this to be championed by someone with sufficient seniority to assemble a team made up of representatives from across the organisation, as all have an important role to play. The team will gather information, assess the vulnerabilities, identify risks and mitigation as well as determine who needs to be involved. This will include liaison with the emergency services (in particular the fire brigade); making links with conservators, regional and

national organisations, local authority emergency planners; assembling contact lists of colleagues and trades people who can be called out in an emergency; assembling laminated site and room plans showing the location of utilities, or 'snatch lists' of key items if there are collections. When the plan is completed and agreed, test it regularly; do your phone numbers still work? Will the 24-hour glazier really come at 3am? Regular rehearsals of the plan help minimise panic in a real emergency.

Reaction starts with the discovery of the emergency and often involves evacuation, liaison with emergency services, funders, insurers and the press, securing and weather proofing the premises and emergency salvage. People-welfare, effective communication and good record keeping are paramount to achieving long term normality.

Recovery is the long haul back and may take months or years; wherever possible use the disaster as an opportunity, for example by giving tours of the repair.

Cleaning up Ironbridge

The watercourse in Coalbrookdale flooded on 19 June 2007 and again on 25 June following heavy rainfall. A third flood, again caused by heavy rainfall, took place on 20 July. Up to 60 properties including listed buildings and parts of the museum complex were flooded. This has resulted in considerable clean-up costs to remove silt and contamination; initial costs to the Ironbridge Institute Museums were in the order of £66,000 with an estimated £100,000 for next stage costs. The emergency plan for the museum worked well. In January 2008, the children's museum Enginuity was still being refurbished with the aim of reopening by the spring half term.

One particular problem seems to be that silt deposition in the watercourse since 1995 has raised the level of the water above that of the surrounding cottages. Engineers from the local authority were meeting with the Environment Agency to assess the amount of silt and debris deposition along the length of the watercourse and how this can be best removed to prevent flooding in the future.

The UK government has been successful in its bid for 'clean up' funding to the EU Solidarity fund and ministers are currently considering how to allocate the funds.

Review the plan in light of your experiences when back to normal. Do not just forget it. Make sure that you share your experience with others and remember lightning often does strike twice!

For further advice about managing disasters please see the list of websites on p 41.

European Perspective

Alexandra Coxen
Senior Policy Officer, English Heritage

We all know that climate change is dominating the European Union political agenda, and indeed has been since the early 1990s. And rightly so. Climate change is not going to stop at the borders and politely be turned away by immigration. The most recent European Commission 'package' on energy efficiency and climate change presented to the European Parliament is calling for renewables to provide one fifth of Europe's energy needs by 2020 (currently at 8.5 per cent), for a 20 per cent increase in energy efficiency and a 20 per cent reduction in greenhouse gas emissions by 2020. These are going to be difficult targets to meet, and the heritage sector is now recognising that the historic building stock of Europe is at risk as the environmental argument starts to override the one for historic integrity. Plastic windows are just one of the battles to be fought (and hopefully won).

Research at national level has already begun into specific problems such as plastic windows, energy-efficient light bulbs and the embodied energy of historic building materials, but only now is the heritage sector beginning to respond collectively at the European level to this increased pressure to find energy efficient solutions for historic buildings.

At the end of 2007 the Heritage Agency of Denmark commissioned a Europe-wide survey seeking to map existing knowledge and research that has been undertaken in relation to energy improvements. This is being undertaken with a view to developing a common methodology for improving the energy efficiency of buildings without diminishing their historic importance and will identify areas where further (collaborative) research is needed. Responses are still being collected.

The results of this survey will be launched at the next European Heritage Heads Forum (EHHF) meeting in Copenhagen on 29–30 May 2008 and will be available on its website from June **www.ehhf.net**.

Finding Out More

The climate change agenda is creating a proliferation of scientific reports, policy papers and guidance documents. In these two pages we list a selection of the most important publications and websites for those concerned with the impact of climate change on the historic environment.

The background to climate change

Readers interested in the global evidence for climate change will find the website and publications of the Intergovernmental Panel on Climate Change (IPCC) of particular value (**www.ippc.ch**). Closer to home, the United Kingdom Panel on Climate Change (IPCC) is the primary official source of historical data and projected climate change scenarios for the UK (**www.ukcip08.org.uk**). Within government, the information and policy lead in this field is provided by Defra, whose web pages contain many further useful links. (**www.defra.gov.uk/environment/climatechange**). English Heritage's own resources on the subject can be found at **www.english-heritage.org.uk/climatechange**

Climate Change and Your Home

To help home owners understand the impact of climate change on older buildings English Heritage will soon be launching a new website, *Climate Change and Your Home* (**www.english-heritage.org.uk/climatechangeandyourhome**). In addition to clearly signposted information on the impacts of climate change, it will provide guidance on improving the energy efficiency of traditionally constructed buildings without harming their character and appearance.

Climate change and HELM

This new section of the HELM website (**www.helm.org.uk/climatechange**) provides a central source of professional advice on climate change and the historic environment and on the implications of adaptive responses and renewable energy policy. Listed publications range from the implications of climate change for World Heritage Sites to energy-saving in historic buildings and the heritage implications of coastal defence. Amongst recent and forthcoming titles are:

Climate Change and the Historic Environment

This statement sets out English Heritage's latest thinking on the implications of climate change for the historic environment. It is intended both for the heritage sector and also for those involved in the wider scientific and technical aspects of climate change; in the development of strategies and plans relating to climate change impacts; or in projects relating to risk assessment, adaptation and mitigation.

Energy Conservation in Traditional Buildings

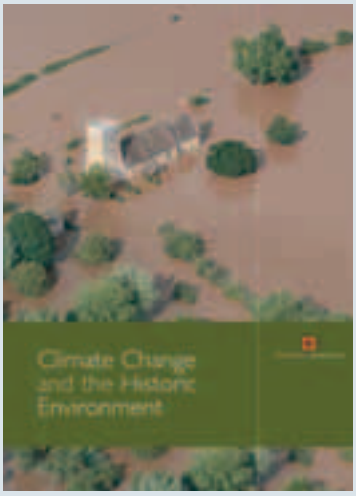
This practical guide tells owners and occupiers of historic buildings how they can make their homes more energy efficient. It deals with improvements that are within the capabilities of a competent DIY enthusiast rather than the more complex changes that would require expert advice and help.

Micro Wind Generation and Traditional Buildings

This is the first in a new series of publications telling home-owners what they need to consider before installing renewable energy systems in historic buildings. Others will cover solar thermal, solar electric (PV), air- and ground-source heat pumps, combined heat and power (CHP) and rainwater and grey water recovery.

Buildings Regulations (Part L) Guidance

The revised Part L of the Building Regulations, which came into force on 1 April 2002, seeks to improve the energy efficiency of all buildings, especially through improved insulation. In the next few months English Heritage will publish a new suite of technical notes explaining how the implementation of Part L can be carried out with the minimum of harm to historic buildings.



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Climate Change and Urban Green Spaces (2007). London: Neighbourhoods, Cities and Regions Analysis Division, Communities and Local Government

Planning Policy Statement 1: Delivering Sustainable Development (2005). London: Office of the Deputy Prime Minister

Meeting the Energy Challenge: A White Paper on Energy (2007). London: The Stationery Office.

Sustainable Design, Climate Change and the Built Environment (2007). London: CABE

UK Climate Change Programme: Annual Report to Parliament (2007). London: Department for Environment, Food and Rural Affairs

ENGLISH HERITAGE PUBLICATIONS

(Available from English Heritage Customer Services, PO Box 569, Swindon SN2 2YR (tel: 0870 333 1181; fax: 01793 414926) or as downloadable pdf files from: **www.helm.org.uk** (following links from Guidance Library)

After the Storms (1997). Product Code XH20065

Biomass Energy and the Historic Environment (2006). Product Code 51100

Building Regulations and Historic Buildings: an Interim Guidance Note on the application of Part L (2004). Product Code 50900 (NB new detailed guidance on the application of Part L will be available later in 2008)

Climate Change and the Historic Environment (2008). Product Code 51392

Coastal Defence and the Historic Environment: English Heritage Guidance (2003). Product Code 50756

Conservation Principles: Policies and Guidance for the Sustainable Management of the Historic Environment (2008, forthcoming). Product Code 51393

Energy Conservation in Traditional Buildings (2007). Product Code 51367

Flooding and Historic Buildings: Technical Advice Note (2004). Product Code 50776

Ground and Air Source Heat Pumps and Traditional (2008, forthcoming).

Lightning Protection for Churches: A Guide to Design and Installation (2000). Product Code XH20087

Micro Wind Generation and Traditional Buildings (2007). Product Code 51366

Micro-generation in the Historic Environment (2008, forthcoming). Product Code 51391

Rainwater and Greywater Use and Traditional Buildings. (2008, forthcoming)

Shoreline Management Plan Review and the Historic Environment: English Heritage Guidance (2006). Product Code 51238

Small Scale Solar Electric (Photovoltaics) and Traditional Buildings (2007). Product Code 51370

Surge Protection Equipment: A Guide to Selection and Installation in Historic Buildings (2003). Product Code 50498

Understanding SAP Ratings for Historic and Traditional Homes: English Heritage Interim Guidance (2007).

Wind Energy and the Historic Environment (2005). Product Code 51099

USEFUL WEBSITES

CABE Sustainability Campaign
www.cabe.org.uk/default.aspx?contentitemid=189

CIRIA (advice on flood prevention)
www.ciria.org.uk/flooding

Climate Change and Your Home
www.english-heritage.org.uk/climatechangeandyourhome

HELM Climate Change
www.helm.org.uk/climatechange

ICON (advice on conservation of items)
www.icon.org.uk

Intergovernmental Panel on Climate Change
www.ipcc.ch

RIBA Climate Change Programme
www.architecture.com/findoutabout/climatechange

UK Climate Impacts Programme (UKCIP)
www.ukcip08.org.uk

UK Climate Change Programme
www.defra.gov.uk/environment/climatechange/

UK and Ireland Blue Shield (British Library)
www.bl.uk/services/npo/blueshield/disaster.html

UK Resilience (Cabinet Office)
www.ukresilience.info

News from English Heritage

Coastal heritage and regeneration

In October 2007 English Heritage hosted a major conference to celebrate the rich but inadequately appreciated architectural legacy of England's seaside towns. The event was attended by more than 180 delegates, including four MPs, and one of its key aims was to demonstrate the crucial role that the heritage can play in the social and economic regeneration of coastal towns and communities. To make sure this evidence reaches the widest possible audience of opinion-formers and decision-makers a series of parallel publications include the policy guidance document *Regeneration in Historic Coastal Towns*, a new monograph on seaside architecture, *England's Seaside Resorts*, a supporting research report *An Asset and a Challenge: Heritage and Regeneration in Coastal Towns in England* and an illustrated book focusing on the rich seaside heritage of Margate.
Contact: Tim Brennan, tel: 0207 973 3279;
e-mail: tim.brennan@english-heritage.org.uk

Heritage Counts 2007

The sixth annual survey of the state of the England's historic environment was launched on 31 October in Greenwich. In a well-received opening speech James Purnell, then Secretary of State for Culture, Media and Sport, said 'I want to work across government to continue to make clear the important connections between the built environment and the wider government agenda – be that housing, education or place making'.

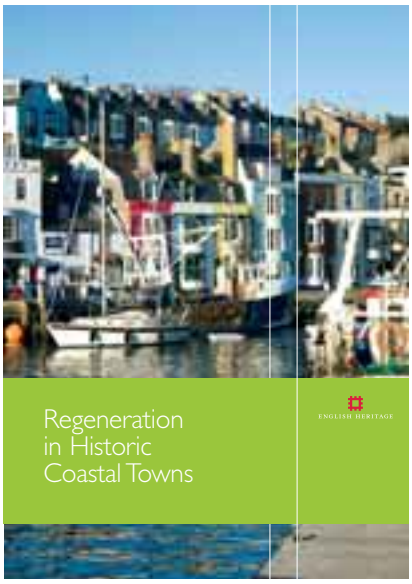
It is five years since the publication of the original *State of the Historic Environment Report* and this year's report looks at the principal trends in the historic environment since 2002. It also includes a focus on the historic environment as a learning resource and on the issues faced by the sector in relation to the skills of the workforce. Alongside this national report, a suite of supporting reports provides further detail on the state of the historic environment in each of the nine government office regions. Copies of all these documents can be downloaded from **www.english-heritage.org.uk/hc**
Contact: Peter Robinson, tel: 0207 973 3730;
e-mail: peter.robinson@english-heritage.org.uk

History Matters campaign

As a follow up to 2006's hugely successful *History Matters – Pass It On* campaign the National Trust, English Heritage, Heritage Link, Heritage Lottery Fund and the Historic Houses Association, have launched a joint publication to remind government, the media and opinion formers of the public's enormous enthusiasm for its shared national and local heritage (**www.historymatters.org.uk**). More than 1.2 million people took part in hundreds of events and activities across the country and an astonishing 46,000 people wrote 'One Day in History' diaries that are now archived for posterity in the British Library. The overwhelming message from *History Matters* is that people care. History fuels a passionate fascination with the world around us, it underpins our individual and collective identities and it informs out priorities about the future.
Contact: Yvonne Harris, tel: 0207 973 3852;
e-mail: yvonne.harris@english-heritage.org.uk

Building in Context toolkit

New development is good for the economy and vitality of our towns and cities. But how do we deal with new development in existing places, especially when they are of historic and architectural importance? Developed by English Heritage, CABE and the Kent Architecture Centre, the *Building in Context Tookit* is a training programme that gives decision makers a framework to help them ensure that projects respond well to their surroundings. Aimed at local authority Design Champions and Historic Environment Champions it is being offered free of charge to local authorities in all of England's regions. More information about the toolkit and its resources can be found at **www.building-in-context.org**
Contact: Charles Wagner, tel: 0207 973 3826;
e-mail: charles.wagner@english-heritage.org.uk



Piling and archaeology

English Heritage has recently published guidance on *Piling and Archaeology*. This guidance has been prepared to assist planning and archaeological officers, developers and their consultants on the relative merits of a range of piled foundations.

The guidance contains sections summarising the different types of pile, their impacts upon archaeological deposits, and a range of mitigation options available to manage and reduce these impacts. Case studies are provided to illustrate some mitigation strategies, along with a summary of best practice and recommendations for further research. The guidance draws on field and laboratory research carried out over the last ten years, and provides guidance based on up to date understanding of piling impacts and the most appropriate methods of mitigating these affects.

Contact: Jim Williams, tel: 01604 735451 or 07801 213300;
email: jim.williams@english-heritage.org.uk

Minerals Guidance

Minerals are all around us in the historic and natural environment, whether on or below the ground or in marine and other submerged contexts. From the stone in Stonehenge to the iron in Ironbridge, the extraction of minerals in prehistory through to the modern era is a story of remarkable human endeavour and ingenuity. Some of our most remarkable and characteristic landscapes have been formed by millennia of mining and quarrying activity and the continued supply of some minerals is fundamental to the upkeep of our locally distinctive built heritage. Nevertheless, the scale and technical proficiency of the modern extractive industries means that they can have a profound effect on what we value most about the historic environment.

This document sets out the English Heritage position on mineral extraction and the high-level policies that will form the basis for responses and views put forward by English Heritage on any matter relating to the winning, working and safeguarding of minerals. Its principal purpose is to guide the work of English Heritage, but it will also be of interest to the wider historic environment sector, government, local authorities, the minerals industry and other organisations that care for the environment.

Contact: Jon Humble, tel: 01604 735455 or 07771 885381;
email: jon.humble@english-heritage.org.uk

HELM HISTORIC ENVIRONMENT LOCAL MANAGEMENT

The HELM website is a one-stop-shop for historic environment guidance and information. Its aim is to provide decision makers in local authorities, regional agencies and national organisations with the tools to manage change in the historic environment with increased skill and confidence.

Expert English Heritage guidance specially tailored for distribution through HELM covers topics as diverse as regeneration, housing, renewable energy, mineral extraction, farming historic landscapes, areas of outstanding natural beauty, historic school buildings, transport and streetscapes.

The website also contains information on training events, useful web links and news. There are searchable databases of good practice case studies and of local authority historic environment publications. These have been collected from across England to encourage the sharing of knowledge, experience and good practice across the sector.

HELM and other English Heritage guidance can be read online or downloaded as PDF documents from **www.helm.org.uk**. We are continually updating the site with more guidance and policy, so please join our email list to receive news. A database of guidance on the historic environment produced by local authorities, amenity groups and other bodies is also continually updated.

For more information about Helm just visit **www.helm.org.uk**

The National Monuments Record
News and Events

The NMR is the public archive of English Heritage. It includes more than 10 million archive items (photographs, drawings, reports and digital data) relating to England's historic environment. Catalogues are available online and in the NMR search room in Swindon. Contact the NMR at:
NMR Enquiry & Research Services,
National Monuments Record, Kemble Drive,
Swindon SN2 2GZ
tel: 01793 414600
fax: 01793 414606
email: nmrinfo@english-heritage.org.uk
web: **www.english-heritage.org.uk/nmr**

Recent NMR acquisitions

In 2007 the NMR acquired two important published records, which constitute some of the earliest-known photographic interiors of Westminster Abbey and some early records of archaeological finds.

Westminster Abbey

The Interior of the Abbey of Westminster is a published set of 23 photographs that depict the medieval monuments inside Westminster Abbey. Taken in 1860 by the photographer Victor A Prout, these are probably the first detailed interior views of the abbey and they show some of the major funerary monuments prior to later restorations. Before this date, photographic technology was not sufficiently advanced to deal with the problems of window glare and gloomy recesses and therefore could not create adequate records. The only other known copies of this publication are in Westminster Abbey Archives and the Canadian Centre for Architecture in Montreal.

Westminster Abbey in 1860. A view looking east along the South Ambulatory towards Henry VII's Chapel with St Nicholas Chapel on the right. The tomb of Edward III is to the left.
© English Heritage. NMR AL2028/003

Four fibulae photographed at Leeds in 1868. The lower, enamelled specimen is Saxon, the two smaller ones are Roman, while the large example is from Denmark.
© English Heritage. NMR AL2029/008

Archaeological finds

A detailed series of archaeological finds were part of the *National Exhibition of Works of Art* mounted in Leeds in 1868, and clusters of these were published in 16 photographs by Cundall & Fleming of New Bond Street in 1869. All show objects made of gold, bronze and other media then in private collections. Some of the objects are now known to be in public collections but others must be unique early records of ornaments and jewellery excavated in Britain and abroad during the 1850s and since lost.
For further information, please contact: Ian Leith, NMR Acquisitions Officer, tel: 01793 414730; email ian.leith@english-heritage.org.uk

Online resources from the NMR

New look to our websites

The *Images of England*, *PastScape* and *ViewFinder* websites have all been revamped. They now have a standard 'look and feel' and you can easily switch between all three.

Images of England: documenting the past for the future. This bridge at the head of Boscastle Harbour, Cornwall, was photographed in 2001 prior to the devastating flood of 2004.
© Mr N E Ward (IOE 68728)

Images of England

Images of England (**www.imagesofengland.org.uk**) is a unique online photographic record of England's listed structures. The project has finally come to an end after seven years of hard work by our volunteer photographers and more than 13,000 rolls of film, and The *Images of England* 'point-in-time' website is now complete with some 320,000 images of England's listed buildings.

The completion of the project was officially celebrated at an event held at Wellington Arch, London, in September 2007. Many friends of the project attended and had the opportunity to view the new-look website. Host and keynote speaker, Dr Simon Thurley, Chief Executive of English Heritage, marvelled at the project's tremendous achievement and value to future generations. He pointed out how the website shows that listed buildings are not just country houses but include many more unusual structures, representing the extraordinary array of cultural achievements England has to offer.
For further information please contact: ioeenquiry@english-heritage.org.uk

Standards

MIDAS Heritage

English Heritage has worked with the heritage sector during the last three years to complete *MIDAS Heritage*, a new UK-wide data standard to assist the sharing of knowledge of the past. That knowledge is contained in many hundreds of databases held by different organisations up and down the country, run by local authorities, national agencies, university departments and amenity societies. Different approaches mean that the same buildings or archaeological sites are recorded in different ways by different organisations, making it difficult to get a full picture.

Building on the success of an earlier edition, *MIDAS Heritage* for the first time relates to all the interests of the UK heritage sector. It sets a standard for the records that document individual buildings or sites, but also covers whole areas of towns or landscapes at one end of the scale down to individual artefacts at the other.

MIDAS Heritage also sets new standards for recording the work undertaken to understand, protect and manage change to the historic environment. *MIDAS Heritage* will make it easier to find out what work has been done, how decisions were made and where to find out more.

Is it just for 'techies'? No. Although the actual sharing of digital data between organisations needs specific agreed technical standards such as XML schemas, that work can start only when there is agreement on what the information is that we need to share. *MIDAS Heritage* puts that agreement in place, so it is relevant for everyone who manages a database in the heritage sector.

Because this edition is an electronic publication, it will be updated on a regular basis, and the heritage sector is encouraged to submit updates and new areas for inclusion. Just send in your suggestions via the new website at: **www.midas-heritage.info**.

Moving forward, the Forum on Information Standards in Heritage (FISH) (**www.fish-forum.info**) will maintain the new *MIDAS Heritage* standard on behalf of the sector. For further information, please contact: Lisa Mullen, Information Standards & Partnerships Manager, tel: 01793 414727; email: lisa.mullen@english-heritage.org.uk

MIDAS HERITAGE
The UK HISTORIC ENVIRONMENT DATA STANDARD

MIDAS Heritage is the UK data standard for information about the historic environment – a vital key to sharing knowledge about the past contained in many hundreds of separate databases up and down the country.

Legal Developments
Not all that looks green is gold

Mike Harlow *Legal Director, English Heritage*

A proposal to install a domestic wind turbine sits on the moral high ground. In practice, the turbine may be sited far below – in a steep-sided windless valley surrounded by tall historic buildings.

A wind turbine may cost more in energy to produce and deliver to site than it ever generates in its lifetime. If the proposal has no real impact on the historic environment, perhaps it does not matter that its green credentials mean the new kit will be nothing more than a dinner party talking point. But when a planning application comes forward that is potentially harmful, what support is there within the planning law and policy framework for an argument that the damage to the historic environment should not be outweighed by something that is only green on the surface?

The issue is covered by *PPS 22: Renewable Energy*. Although this policy is principally concerned with large-scale wind farms and the like, its approach is of equal application to micro-generation. This national policy is, of course, very supportive of increased development of renewable energy resources. But it does not provide blanket blessing for categories of development. It says 'the wider environmental and economic benefits of all proposals for renewable energy projects, whatever their scale, are material considerations'. It adds that '*development proposals should demonstrate any environmental*, economic and social *benefits* as well as how any environmental and social impacts have been minimised through careful consideration of location, scale, design and other measures' (my emphasis; Key Principles 1(V) and (VIII), PPS 22).

In the usual hierarchy, regional spatial strategies and local development plans should follow this national policy. As an example, the London Borough of Camden's planning guidance almost steps into line, saying that while the importance of renewable energy may mean that a greater level of visual impact is acceptable than would otherwise be the case, 'viability of the installation in providing a reliable source of energy must be proven'. This is focusing on a narrower issue than the broad assessment of demonstrable environmental benefits that PPS 22 refers to.

Examining the net environmental effect of the proposal logically must take into account the energy cost of materials, production, importing, erection and maintenance. Simply looking at whether something will be a net producer of electricity on any given day is to ignore other elements of the environmental equation.

This holistic view should obviously be part of any sensible decision and so such data ought to be obtained from the manufacturer and presented as part of the application. In reality, though, there may be significant difficulties in establishing the true environmental credentials. A certification scheme would clearly help. I understand there are some in gestation.

The national policy does not suggest that one renewable energy idea can be rejected simply because it is not as environmentally advantageous as another. Nor is the government keen to persuade owners to look at works to improve efficiency (like double-glazing) before generation. It is clearly for the owner to choose their green approach.

> 'Planning policy is not blind and there is no need to accept that all that is labelled green is gold.'

Critically, of course, environmental justification for harm can only be taken into account when there is a need for planning permission. Government has consulted on the introduction of permitted development rights to take away the need for a planning application for certain microgeneration equipment. The viability of a particular approach could not then be assessed in the circumstances of the site. That said, permitted development rights within conservation areas should be more limited and listed building consent will always be required where there are works to a listed building (or a curtilage building) that affect its special character.

In any event, local authorities should have the power to issue an Article 4 direction to remove such permitted development rights where the historic environment justifies it.

Government policy is clearly very supportive of initiatives that genuinely reduce our burn through the world's resources. But planning policy is not blind and there is no need to accept that all that is labelled green is gold. This is not an anti-green point. It is itself anti-green to waste resources on equipment that will have no positive environmental effect, whatever it seems to promise.

New publications from English Heritage

Throughout 2008 Liverpool will be celebrating its status as European Capital of Culture. As its own contribution to the event English Heritage is publishing five new books that explore the buildings and places that give this great mercantile city its unique character.

Like other titles in the Informed Conservation series, the aim of these books is to show how a greater understanding of an area's buildings and public spaces can make a significant contribution to its future social and economic well-being.

Building a Better Society: Liverpool's Historic Institutional Buildings
by Colum Giles

Liverpool's landscape, both in the city centre and throughout its historic suburbs, is studded with institutional buildings, some – like the great hospitals – very prominent, others – like Sunday Schools and chapels – punctuating ordinary street scenes. All, however, tell the story of how charity and public authorities responded to the desperate need of the poor and vulnerable in the 19th century.

Attractively illustrated by photographs and drawings, this book emphasises the importance of institutional buildings to our understanding of Liverpool's character and demonstrates how new uses can ensure that they continue to form part of the city's historic environment.

PUBLICATION DATE: March 2008
PRICE: £7.99 + P&P
ISBN: 978 1 905624 14 0 /
PRODUCT CODE 51332
Paperback, 80pp

Built on Commerce: Liverpool's Central Business District
by Joseph Sharples and John Stonard

The vast trade that passed through Liverpool's historic docks was managed and organised in an increasingly specialised and sophisticated business district. New and ever-larger offices, banks, warehouses and salerooms, often innovative in design and of spectacular architectural quality, were built in a highly concentrated area, which powerfully represents the confidence and prosperity of the period.

This book, attractively illustrated by photographs and drawings, tells the story of the business quarter from the 18th century to the present day and emphasises that conservation of historic commercial buildings is important in retaining the area's distinctive character.

PUBLICATION DATE: March 2008
PRICE: £7.99 + P&P
ISBN: 978 1 905624 34 8 /
PRODUCT CODE 51331
Paperback, 80pp

Religion and Place: Liverpool's Historic Places of Worship
by Sarah Brown and Peter de Figuereido

From unpromising beginnings as a small fishing port with only one church, Liverpool grew to be a city of churches and chapels. In the 20th century some of the most exciting English churches of the period were built in Liverpool. However, shrinking congregations and the decline in clergy numbers have all taken their toll on Liverpool's places of worship. Those that remain face many challenges, but with energy, imagination and the right kind of help the places of worship celebrated in this profusely illustrated book can remain some of the most beautiful, exciting and diverse aspects of Liverpool's historic environment.

PUBLICATION DATE: May 2008
PRICE: £7.99 + P&P
ISBN: 978 1 873592 88 5 /
PRODUCT CODE 51334
Paperback, 80pp

Places of Health and Amusement: Liverpool's Historic Parks and Gardens
by Katy Layton-Jones and Robert Lee

This book explores the rich legacy of parks in Liverpool, from the forgotten open spaces of the 18th-century town, through the pioneering creation of a 'ribbon of parks' in the 19th century, a period of decline after the Second World War, to the situation today.

Attractively illustrated with archive and contemporary photographs and drawings, the book shows how parks have been used and enjoyed, how they have changed to meet new challenges and ideas, and how the arguments used to justify their creation in the 19th century are being used again to spark a revival in their fortunes and future.

PUBLICATION DATE: July 2008
PRICE: £7.99 + P&P
ISBN: 978 1 873592 91 5 /
PRODUCT CODE 51333
Paperback, 80pp

Ordinary Landscapes, Special Places: Anfield, Breckfield and the Growth of Liverpool's Suburbs
by Adam Menuge

Most of England's larger towns and cities are ringed by extensive suburbs dating from the 19th and 20th centuries. They range from the opulent, spacious and leafy villa suburbs of the prosperous middle class to the dense gridirons of working-class and lower middle-class housing. The product of rapid urbanisation and industrialisation, these suburbs, once derided or disregarded, now face major change themselves. The story that emerges will surprise many, and may prompt a re-evaluation of these 'ordinary' places.

PUBLICATION DATE: September 2008
PRICE: £7.99 + P&P
ISBN: 978 1 873592 91 5 /
PRODUCT CODE 51343
Paperback, 80pp

SPECIAL OFFER

Until 30 June 2008 the first three of these titles (*Building a Better Society*, *Built on Commerce* and *Religion and Place*) will be available to *Conservation Bulletin* readers for the special price of £5.99 plus £1.50 p&p per item through English Heritage Postal Sales at the address shown above right.

Publications may be ordered from English Heritage Postal Sales, c/o Gillards, Trident Works, March Lane, Temple Cloud, Bristol BS39 5AZ;
tel: 01761 452966; fax: 01761 453408;
email: ehsales@gillards.com
Please make all cheques payable in sterling to English Heritage.
Publications may also be ordered from www.english-heritage.org.uk

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