THE NATIONAL TRUST

**REVIEW OF THE UK CLIMATE CHANGE PROGRAMME**

**A response by the National Trust to the Government's consultation paper**

**March 2005**

[This version does not contain any photos]

**Summary**

1. The National Trust welcomes the opportunity to contribute to the review of the UK Climate Change Programme. Our response focuses on the practical challenges of adapting to climate change within a stronger policy framework for reducing emissions. In many ways the National Trust's properties act as a "canary" – showing early signs of the impacts of climate change all around us. We highlight the reality of the impact of climate change on the places in our care today and the difficult management choices that we already have to make. In developing the Climate Change Programme we emphasise:

- support for the goal to reduce carbon dioxide emissions by 60% by 2050 as a minimum and the need to build the future Programme around this longer term goal

- a strengthened focus on energy efficiency and micro-generation from renewable sources in the policy mix

- stronger action to tackle the increase in emissions from the transport sector – and make specific proposals in the leisure sector

- the need for an adaptation strategy to address current and future climate change impacts, linked to new policy, fiscal and other mechanisms, including:

    - enhanced forms of public dialogue about the choices we all face in living with climate change
    - a Government strategy for natural resource protection backed by new spatial planning arrangements for natural resources
    - funding and fiscal mechanisms which support a more equitable, risk based approach to managing change, including transitional support for relocation of homes and businesses.

**Mitigation**

2. We support the Government's longer term goal to reduce carbon dioxide emissions by 60% by 2050. This is a minimum and the future Climate Change Programme should be built around its achievement. This will allow for a wider range of policy and other responses with targets for 2010 and 2020 considered as important milestones rather than ends in their own right.

3. The National Trust's energy policy is provided in Annex 1. This places a particular emphasis on energy efficiency as a higher priority than development of renewable energy - and a particular focus on renewables in the heat sector as well as the electricity generations sector – and we believe these should feature much more strongly than hitherto in the future Climate Change Programme. We should highlight the need for particular action in three areas:

(a) <u>Building standards</u>

4. Our work with major housebuilders in developing a 710 house scheme at Stamford Brook near Altrincham, Cheshire demonstrates the scope not only for higher building standards to be incorporated into larger scale development but also that the costs of introducing such measures can be significantly overestimated.

5. The development provides evidence that challenges the common perception in the building sector that it is not possible to reconcile costs with sustainability goals. Stamford Brook shows how we are achieving significant cost reductions on energy efficiency measures over time and how environmental measures, which were thought not to be affordable by the developers of the project at the beginning, became so further down the line. In one case the extra cost for a specific element of construction in a dwelling reduced by 80% and in another by 40% in less than a year. A note on the project is provided in Annex 2. This was prepared by Leeds Metropolitan University who are working on a DTI/ODPM funded Partners in Innovation project at Stamford Brook with the Trust and the developers to develop a new Part L energy performance standard that is easily transferable to the house building sector as a whole. We wish to emphasise that this housing project is based on building fabric and in-built service energy efficiency measures, that we believe are more durable and more guaranteed to deliver reductions in energy use than if these houses had been fitted with renewable energy technologies.

(b) Micro-generation

6. Successfully increasing the share of renewable energy production without exacerbating current controversies over larger scale on-shore wind turbines will require a more sophisticated policy framework. This needs to result in a greater diversity of renewable energy technologies, successful exploitation of appropriate offshore renewable energy sources and enhanced support for community based and micro-generation schemes. Micro-generation has a particular contribution to make in changing public attitudes and behaviour as well as increasing renewable energy supply and action is needed to reduce the cost of the technology. The Trust supports the *Micro-generation manifesto* published by Green Alliance in September 2004 which highlights the need to:

- Integrate micro-generation into new build (for both heat and electricity generation)
- Encourage local authorities to plan for community-scale grid network
- Introduce incentives for energy suppliers to develop energy service contracts that enable householders to retrofit schemes
- Reform the fiscal framework – e.g. through stamp duty rebates for low carbon homes
- Develop simple procedures for householders and small businesses in applying for grants and grid connection.

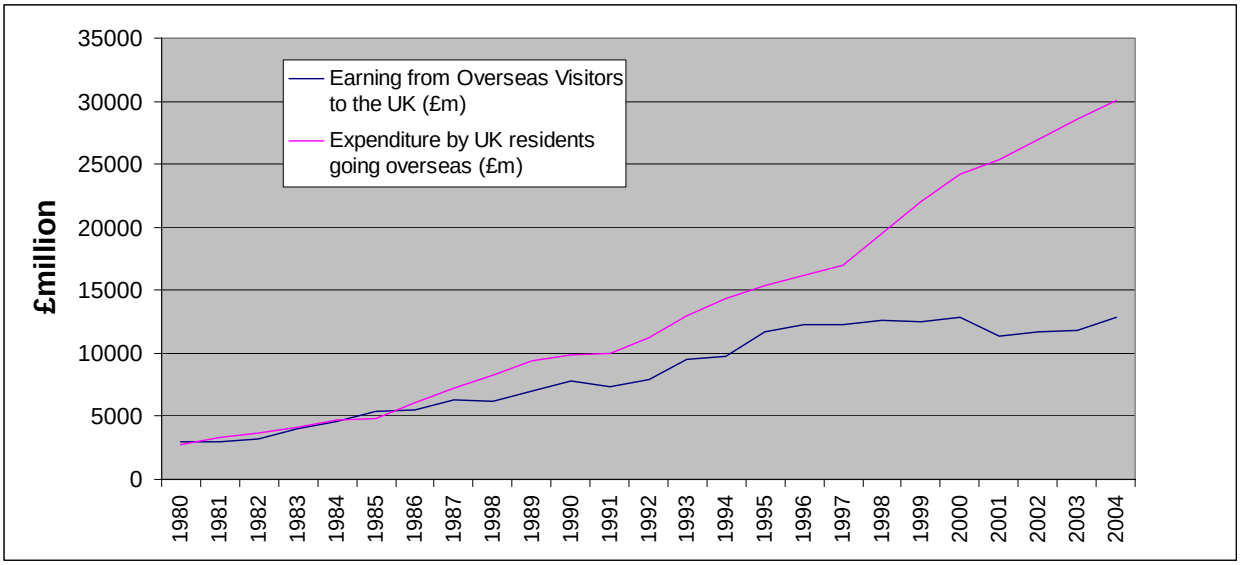
(c) Transport

7. The Trust identifies the growing contribution to greenhouse gas emissions from the transport sector as the most serious contributor to future climate change impacts. It is the only sector which is projected to increase total greenhouse gas and carbon dioxide emissions by both source and end user between 1990 and 2020 and the increases are projected to be by as much as 23%. We do not believe that measures to develop and promote new technologies will fully address the challenge of reducing these trends and urges other action.

8. Drawing on our own experience as a major leisure and tourism operator we should highlight the particular opportunities to introduce practical measures to mitigate future growth in leisure travel by both car and plane:

(i) *Visitor Travel Plans* – Leisure is the fastest growing driver of increases in car use and lacks a coherent policy framework for addressing its environmental and other impacts. As a starting point we urge the extension of the approach to workplace and school travel plans to address visitors to major leisure and tourist facilities and the integration of visitor travel plans into the land use planning system for these developments. This needs to be supported by more effective long term funding of alternatives to the car for leisure journeys.

(ii) *Aviation and domestic tourism* – The impact of the growth in aviation emissions is well documented. 76% of flights are for leisure and this is the fastest growing sector. This is not only driving the growth in emissions but also contributing to a growing and large tourism balance of payments deficit – which has reached £17bn (see graph based on ONS data). The economic as well as environmental case for promoting a much stronger domestic tourism sector is overwhelming.




**Adaptation**

9. We place a particular emphasis on the UK Climate Change Programme addressing the need for a policy framework that allows society to start *adapting* now to learn to live with climate change, to make choices that reduce the risks we all face and to ensure a more equitable distribution of the costs of change. We warmly welcome the commitment to develop a framework for adaptation and our suggestions for its scope are provided in Annex 3.

10. In many respects the Trust's properties act as a "canary" showing the impacts of climate change all around us. This is evident in myriad ways from the management of our coastline, gardens and wildlife assets through to the conservation of our historic collections and our risk from floods and moorland fires. Annex 4 provides further information on these impacts. It demonstrates the urgent need for a strategic framework for adaptation to begin to grapple with the changes in behaviour we need to promote. It also needs to enable other major players who deal with the management of risk and who take a long-term view, for example the finance industry, to share the responsibility for adaptation and reduce the costs.

11. We identify three areas for particular attention in the development and implementation of an adaptation framework:

(a) <u>Improved public dialogue</u>

12. The evidence of the reality of climate change impacts on our properties is overwhelming and we believe a greater emphasis should now be placed on effective communication of its effects and increasing public understanding of the consequences than the gathering of yet more data. This should include significant investment in new forms of communication and public dialogue over the implications and choices we face in adapting to climate change. We would like to see much greater investment in the skills, knowledge and confidence of risk managers and communicators, especially in the Environment Agency, new Integrated Agency and local authorities. Key professional communities include planners and engineers and those engaging with stakeholders and communities. The various regional climate change partnerships also provide a basis for improving knowledge and understanding

in ways that help change behaviour. This is vital if we are to meet the cultural challenge of helping society re-learn how it should live with climate change.

(b) Spatial planning for resource protection

13. An effective framework for adapting to climate change needs to be developed within the context of a coherent Government strategy for natural resource protection and this in turn depends on the coherence of a spatially planned and delivered approach that covers the whole land mass and coast. Yet, given the limited focus of the land use planning system on "development" this is a major gap in the 'toolkit' for addressing these issues. We see the River Basin Management Plan (RBMP) required under the Water Framework Directive as the most sensible current basis for wider spatial planning, encompassing both Catchment Flood Management Plans and Shoreline Management Plans. RBMPs have much to offer beyond bureaucratic EU compliance, as they provide a means of delivering solutions tailored to work at a geographically sensitive scale. It will be vital to ensure local accountability for delivery.

14. We believe that in the longer term, the wider spatial planning framework for natural resources needs a statutory basis that complements the land use planning system. In the meantime, planning at the catchment and coastal cell level needs visible political commitment. Government leadership and guidance through strengthened PPSs 20 and 25 would be a practical way to embed the recommendations of Catchment Flood Management Plans and Shoreline Management Plans within Local Development Frameworks and Regional Spatial Strategies. We are concerned by the lack of any recognition for this key area of public policy development in ODPM's current review of the legislative and policy base of the land use planning system.

(c) Funding and risk

15. Current funding arrangements and fiscal incentives for adaptation are both sparse and weak. The development of an adaptation framework will require a broader and more imaginative approach that covers the full implications of moving towards a risk-based approach to managing change. This will require, for example, new mechanisms in insurance, compensation and long term management. Relying on conventional products and timescales will be wholly inadequate. For example, we believe a relocation package in response to coastal change and flooding is essential to adapt to climate change in a socially equitable way and would like to see this developed drawing on wider national and international experience. Over the next twenty to fifty years there will be many more homes and businesses unable to secure private insurance and mortgages. If we do not provide transitional support, we risk creating pockets of deprivation and potentially ghetto communities. This is because those who can afford to manage risk either by moving away or privately investing to protect themselves in the short term will do so, whereas poorer households and businesses are less able to adapt. This leaves them highly vulnerable to loss of assets and in the worst cases to loss of life. The private actions from individuals to avoid adaptation – such as through coastal defences - can also increase the burden of risk to neighbours and others, including the Trust.

**Annexes**

1 The National Trust's energy policy
2 Stamford Brook – project costings
3 Adapting to climate change
4 Climate Change impacts – National Trust case studies
- National Trust Coastal Risk Assessment and management principles
- Westbury Court Gardens: adaptation options
- High Peak Estate – moorland fires and blanket peat
- Climate change and gardens
- Historic houses and interiors
- Lake District – drought

## THE NATIONAL TRUST'S ENERGY POLICY

The National Trust's energy policy is based on 4 principles:

i) a presumption in favour of energy efficiency as the primary method for reducing fossil fuel consumption, thereby enabling renewable energy sources to substitute fossil fuels within an overall framework of reduced energy consumption;

ii) a presumption in favour of renewable energy developments where they can be shown to actually and permanently displace fossil fuel consumption; this should apply to the use of renewables for electricity generation as well as for other forms of energy (heat, motive power);

iii) a presumption against renewable energy developments in high quality environments, including designated areas, unless the impact of the development can be shown to be insignificantly negative (perhaps because of its nature or temporary duration) or benign;

iv) a commitment that the Trust is developing targets for energy efficiency and for the extension of renewable energy sources on its properties, as a contribution to public targets for greenhouse gas emissions and renewable energy generation.

## STAMFORD BROOK - PROJECT COSTINGS

Throughout the house design period, like any other project, cost was a consideration. However, the research team felt that much of the design discussion was not actually cost-led and that design solutions were debated to get the best environmental and energy solution rather than the cheapest. This may have been because it was accepted that some increase in cost was inevitable and that the Trust wanted to purchase and fulfil as much of their environmental 'Vision' as possible. Naturally, where two solutions had a similar environmental impact, the cheaper one was chosen.

A 'Summary of budget costs' spreadsheet was used to itemise all the house components that had an extra-over cost attached to them. The extra-over was the difference between achieving the current building regulations (ADL 2002) and complying with our own Environmental Performance Standard (EPS). The Summary was regularly updated as new cost information and quotes came in and construction solutions were agreed upon. New versions were distributed to the team on an almost monthly basis. Initial versions were made by the developers and later versions by collaboration between them and the Trust's QS. Initially, costings were done assuming that all houses would be $100m^2$ detached. At this time the precise house mix was unknown. This assumption had the effect of over-estimating items such as wall tie numbers and wall insulation as a detached has more external wall than semi and terraced variants. It was only later that the house mix became predominantly semis and mid terraces in phase 1and the truer cost became apparent.

A theme that emerged regularly at meetings was bulk buying. The fact that the Stamford Brook project was so large (710 dwellings) was thought by the Trust's QS to have sufficient buying power to obtain significant bulk discounts. The developers, though, preferred to let their own supply contracts on a parcel by parcel basis (typically 25 houses at a time) in order to provide flexibility in choice of supplier. The developers were keen not to be 'tied' to suppliers over long periods. How much the promise of extra work affected quotes is difficult to quantify. Each developer did agree to try and share suppliers if their quotes were more competitive. A letter of intent to renew contracts to suppliers as each parcel became available was touted as a compromise but, again, the effectiveness of this strategy was difficult to ascertain. The corollary was that some suppliers could not guarantee their prices over such a long timescale (4-5 years).

Midway through the design period it seemed that not all of the Trust's EPS items could be afforded and each item was weighed against others in an attempt to decide which ones to keep and which to reject. This was a difficult choice as all the items remaining in the EPS had by then already been through a well-debated selection process. By January 2004, though, the Trust decided to include all the EPS items even though this took the cost of the project over budget. The hope was that over the course of the project, costs would come down. If not, some items could be omitted in later phases in order to meet the budget. It was also thought that revision of actual building regulations would change the benchmark from which the extra-over costs were calculated. For instance, if the regulations in 2005 required window U values of $1.3W/m^2K$ (the EPS standard), then there would be no extra-over for that item.

An interesting phenomenon occurred as budget cost was analysed over time. The cost of many items in the EPS did appear to fall and some fell substantially from first estimates. A full report of budget and actual costs will be prepared by the research team later in the project but, in the meantime, two tentative examples are given below to give a flavour of the findings so far. Examples for plastic wall ties and cavity wall insulation are shown in Figures 1 and 2 respectively.

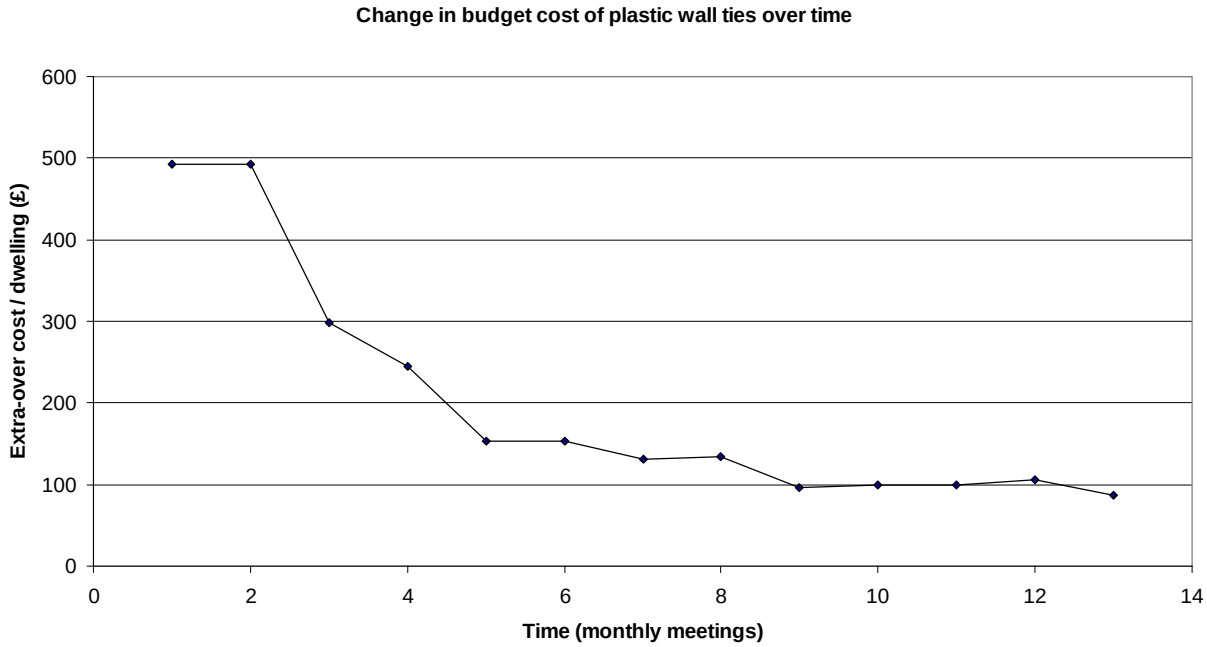



Figure 1: Change in budget cost of plastic wall ties.

Figure 1 shows a graph of how the budget cost of plastic wall ties changed at each revision (approximately monthly) of the Summary of Budget Costs. The cost is the additional cost taking into account the saving made by not using steel ties. Although first estimates were inevitably high and the way of calculating the figures varied slightly, there was still a marked downward trend as estimates were refined, buildability issues resolved and uncertainty removed. (All figures are normalised to show the cost of using tie spacing of $8/m^2$).

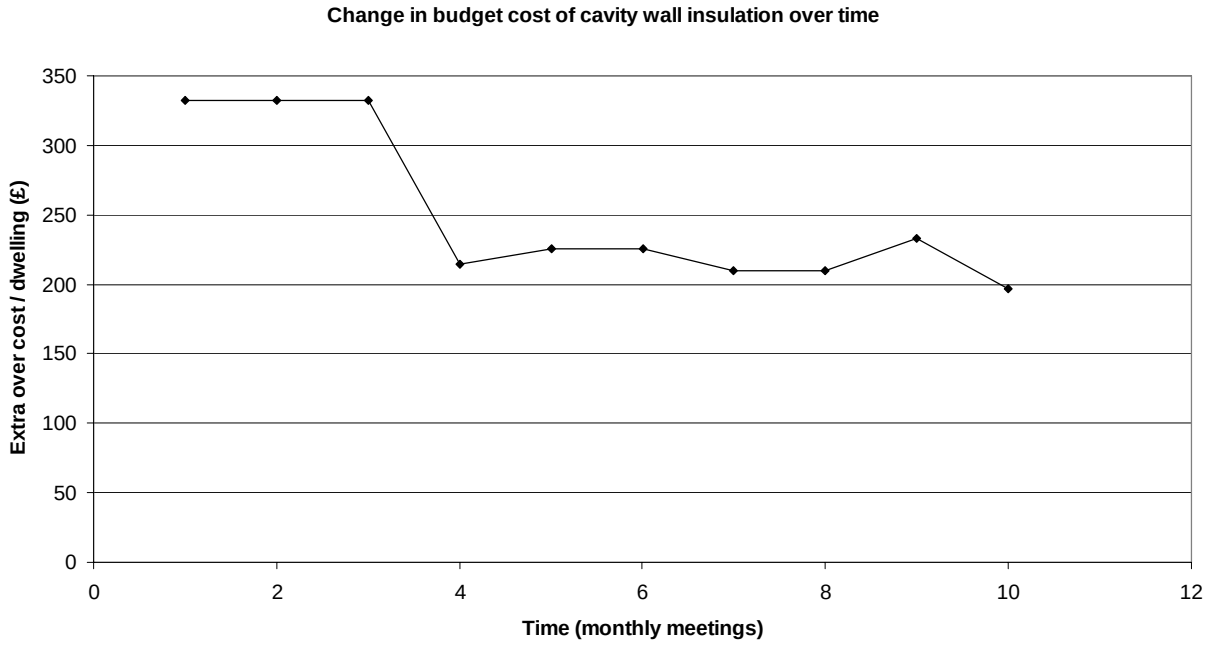



Figure 2: Change in budget cost of cavity wall insulation.

Figure 2 shows a large fall in budget cost of cavity wall insulation from initial estimates and then more conservative changes but still with a general trend downward. Initially, the costs were an average of both developers because of the way they were calculated (points 1 to 8). The last two points (9 and 10)

show the cost for each developer separated out. The extra-over cost for each developer was slightly different as each had a different baseline from which costs were calculated.

March 2004

Prepared by Leeds Metropolitan University on behalf of the National Trust

## ADAPTING TO CLIMATE CHANGE

1. This Annex summarises the National Trust's views on the purpose and scope of a strategy to respond and adapt to the impacts of climate change which are already being experienced domestically. We believe the Government's production of a climate change adaptation strategy would signal how serious and urgent the UK believes the impact of climate change is at home, not just internationally, and help us all to begin to grapple with the changes in behaviour we need to promote. It would also enable other major players who deal with the management of risk and who take a long-term view, for example the finance industry, to share the responsibility for adaptation and reduce the costs.

2. The purpose of a climate change adaptation strategy would be to:

- Identify and prioritise the impacts of climate change happening now in the UK
- Develop people's understanding of the impacts of climate change on daily life
- Stimulate debate on the urgent need to adapt to change and to make connections with the choices we face in behaviour and lifestyle
- Provide direction and greater certainty in forward planning and policy development
- Catalyse innovation in managing risk, from insurance and other financial products through to green technologies
- Reduce the long term cost to society and ensure the costs of adaptation are shared across society

3. The scope of a climate change adaptation strategy would need to cover:

Evidence – bringing together the latest knowledge on the different climate change impacts on the UK

Scenarios – identifying and explaining what this means for people's daily lives through real stories and clear choices as well as statistics

Implications – explaining what the long-term implications for the economy, environment and society from current trends and alternative choices would be

Managing risk – exploring the lessons learned from our own and others experience of living with environmental risk – e.g. international experience with earthquakes and hurricanes

Adaptation – exploring and explaining the main options available, including long term planning, different approaches to insurance and changes to land and coastal management

Behaviour and choices – identifying the different roles and responsibilities of individuals, the Government, and the private and voluntary sector – and the scope for greater partnership and joint action

## CLIMATE CHANGE IMPACTS - NATIONAL TRUST CASE STUDIES

The following examples illustrate the range of impacts that climate change is having on the properties and responsibilities of the National Trust.

### Case Study 1 – National Trust Coastal Risk Assessment and management principles

*The value of a strategic risk-based approach to forward planning and investment combined with managing change with the grain of nature.*

The National Trust is currently undertaking a risk assessment of its 700 miles of coastal interests to obtain an understanding of the increasing pressures arising from climate change, sea level rise, erosion and flooding. The results will be published shortly.

Using *Futurecoast* data, the Environment Agency indicative flood maps and the UKCIP medium risk climate change scenario, the first phase of the study (commissioned from Halcrow) defined the National Trust properties at risk of coastal erosion and flooding on a 100-year time scale. This provided:

i. Desk-based identification of all National Trust coastal sites;
ii. Identification of the types and causes of coastal change in the UK (i.e. changes in the physical and biological processes that determine the evolution of coastal morphology, that may be caused by natural or human-induced factors);
iii. Regional evaluation of rates of change and identification of the coastal areas of England and Wales undergoing the most rapid rates of change;
iv. Identification of the generic National Trust sites and interests in the coastal zone that are most at risk of coastal change; and
v. Identification of a few specific National Trust coastal sites representing these generic interests, to develop as exemplars of how to evaluate, and then respond to, coastal changes;

From the first assessment, the following property-specific generic areas of action were identified as being required:

- Identifying legal liabilities
- Selecting management responses – status quo, natural processes, buying time, emergency, coastal zone scale, recording change
- Planning – NT regional strategies, NT site management plans, coastal spatial planning, prospective acquisitions
- Working with stakeholders – negotiation, communication, education

We are considering subsequent phases of the Coastal Risk Assessment to collect detailed data for all the highest priority sites identified in Phase1 to determine for each what exactly is at risk from erosion and flooding. Detailed action plans can be then be developed.

This will give the Trust a comprehensive overview, in site-specific detail, of the possible implications of coastal erosion and flooding over the next 100 years. From this information the Trust's site managers, and the organisation collectively, will be able to make strategic, forward-planned decisions about which assets can and need to be protected and the implications for doing so.

Drawing on the early results of the work we have developed our own management principles in relation to the coast, which are as follows:

1. The Trust accepts that the coast is dynamic and changing and will work with the natural processes of coastal erosion and accretion wherever possible.

2. The Trust will take a long-term view and will adopt or support flexible management solutions which can enable, or adapt to, the processes of coastal change.

3. The Trust will plan in the context of predicted sea level rise and will favour coastal realignment wherever this can reasonably be accommodated.

4. The Trust will only support interference with natural coastal processes where it believes there is an overriding benefit to society in social, economic or environmental terms.

5. Valued cultural features threatened by coastal change will be conserved and enhanced as far as practicable, whilst not necessarily seeking to protect them indefinitely. The Trust will ensure such features are properly recorded before they are lost or will consider relocation if that can be justified.

6. Valued coastal habitats will be conserved and enhanced as far as practicable, accepting that they will develop or adapt in response to coastal and climate change. The Trust accepts that some habitats and species will be lost or replaced through natural processes and we will consider re-creation elsewhere.

7. The Trust will actively promote public access to the coast, subject to conservation and safety considerations, in order to provide public enjoyment, recreational opportunities and to develop understanding of the coast.

8. Coastal management decisions often impact beyond their immediate location and cannot be made in isolation. The Trust will work with other managers, organisations and communities to share experience and knowledge, to secure beneficial outcomes, to promote solutions on the basis of our experience, and to ensure a shared understanding is achieved of the reasons for the Trust's policies and practices at all levels.

9. The Trust will only support development on the coast which has taken proper account of coastal change and sea level rise as well as environmental, cultural and landscape considerations.

10. The Trust will consider the acquisition of coast where it is the best option to support these principles.

**Case Study 2 – Westbury Court Gardens: adaptation options**

*The value of a risk-based approach to understanding long term impacts from both the terrestrial and marine environment, identifying options for adaptation, providing greater certainty in decision-making.*

Westbury Court Gardens, near Gloucester, are the only fully restored Dutch Water Gardens in the country. Created in 1696, the gardens are rich in period design, architecture and plants. The gardens are likely to be subject to severe tidal or freshwater flooding in the future from the Severn Estuary or the Westbury Brook. The type of flood will determine our response.

The gardens are already suffering the consequences of past freshwater flooding, which introduced *Phytophthora* infection that is now causing the death of yew hedges, a major feature of the gardens. Future freshwater floods are likely to contain *Phytophthora*, leading to sustained infection and death of yew hedges and other plants. As a result, planting areas and beds will have to be left fallow for 7 years (Royal Horticulture Society recommendation), assuming no further floods, before any replanting can be considered. Given this requirement and the certainty of further floods and therefore further *Phytophthora* infection, we may never get a chance to replant the yew hedges again (unless major flood prevention measures are put in place to protect the garden).

A seawater flood is likely to have a catastrophic impact on the garden, resulting in the death of almost all plant material, including trees, shrubs, herbaceous plants and bulbs. Period fruit trees, hedges and grass will also be killed, as will fish in the canals. Salts are also likely to affect the built structures and

lime mortars. The site may well have to be treated as an archaeological site from this time on and access arrangements may need to be reconsidered. Long-term developments in the Severn Estuary (e.g. a tidal barrage across the Severn Estuary) may in the long term turn Westbury into an underwater archaeological site.

The recommendations from this analysis are that it is urgent that the Trust:

- records the garden in its present form: stills photography, video, artist;
- ensures the garden is fully documented and assessed (archival research);
- carries out plant analysis, to establish rarities & those for propagation and relocation;
- devises a communications strategy for the short, medium and long term, to inform the public about the Trust's position on managed retreat in relation to Westbury;
- and installs interpretation material/displays in Pavilion or elsewhere on site.

Other options include retaining the dying and dead yew hedges, at least until the Trust has devised a formal policy for Westbury and has communicated it, and reinstating former vegetable beds on the 'bowling green' lawn to demonstrate and record how the garden looked in the 17 Century.

This analysis has enabled the property staff to consider the implications of the two different types of flooding which can afflict Westbury Court, thereby providing for more effective forward-planned mitigation and post-flood amelioration and restoration works.

**Case study 3 – High Peak Estate – moorland fires and blanket peat**

*The practical challenges of adapting to moorland fires and conserving blanket peat habitats.*

The National Trust protects and manages around 13,000 hectares of moorland in the Peak District. This is a significant proportion of the whole (approximately 25%). Our moors are of national and international significance for a range of features:

- as major water gathering grounds for the conurbations of the north and midlands (Places like Derby, Leicester, Nottingham and Sheffield). The protection of good water quality is therefore vital.
- as vital 'purple' lungs for the people of the northern industrial towns. A fifth of the UK population lives within a short distance of these moors and they represent the closest wild and open country to the cities. Recreational access (with more than 25 different types of activity taking place)is very important both for those visiting and the rural economy. The moors undoubtedly make a large contribution to the physical and mental health of the nation. National Trust moors were open access even before the CROW Act 2000.
- the beauty of the upland landscapes. The national importance of the natural beauty, to which millions of people are attracted each year, is recognised by the National Park designation.
- for their international significance for nature conservation. Most of the moorland block is designated SSSI, a SCI and SPA – particularly for the assemblage of breeding birds, moorland vegetation and extensive deposits of deep blanket peat which, along with many species of moorland wildlife, are at the south-easterly edge of their distribution in the UK.
- the moors are also of importance for their farming and agricultural value – with their economic and cultural associations with local communities.

The North West Climate Change Impact Group, in association with UKCIP, has identified the following likely scenarios for this area of the southern Pennines:

*The current United Kingdom Climate Impact Programme (UKCIP) scenarios for the 2020s and 2080s suggest that the Peak District is likely to experience a number of important changes. The nature of these changes and their anticipated impacts are summarised under UKCIP scenarios in Table 1. Of the four UKCIP emissions scenarios, the high (H) and low (L) scenarios are chosen to reflect the uncertainties about future greenhouse gas emissions and to account for fullest range of change. There is little difference between 2020s high and low scenarios, as the emissions levels have largely been*

*determined by the 50 years of emissions already in the system since the 1950s. Slow-down of Gulf Stream activity is accounted for in the models.*

*Table 1: Predicted climate change for the PDNP under UKCIP high and low emission scenarios*

| ***Variable*** | ***1961-1990 average*** | ***2020s*** | ***2080s*** | ***Max change*** |
|---|---|---|---|---|
| *Average summer temperature (ºC)* | *17.5* | *19.0 (L and H)* | *20.5 (L) 23.0 (H)* | *5.5 warmer* |
| *Winter minimum temperature (ºC)* | *0* | *1.0 (L and H)* | *3.3 (H)* | *3.3 warmer* |
| *Average summer rainfall (mm)* | *246* | *221 (L and H)* | *187 (L) 135 (H)* | *45% drier* |
| *Average winter rainfall (mm)* | *315* | *331 (L) 334 (H)* | *353(L) 387 (H)* | *23% wetter* |

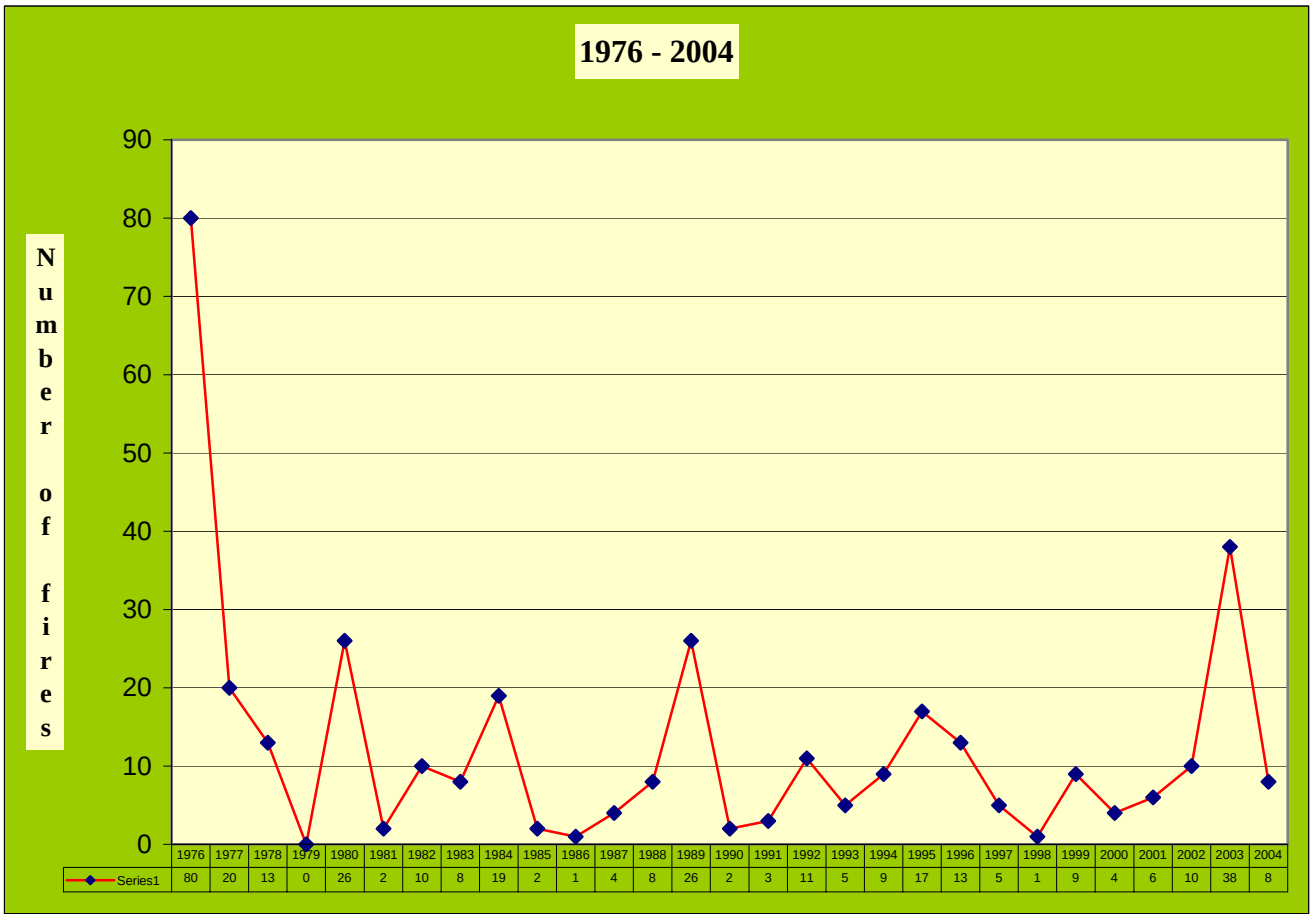
- *Hot summers, such as that of 1976, would become the norm, even under the low emissions scenario. The probability of temperatures over 31 ºC will rise from 1% to 11%, equivalent to a rise from 1 to 11 days per summer under the 2080 high emissions scenario. There is a predicted 1% chance that the temperature will reach 39ºC, equivalent to 1 day per summer.*
- *Reduced seasonality in temperature: warmer summers, milder winters.*
- *Greater seasonality in rainfall: greater contrast between summer and winter precipitation.*
- *Increased probability of intense rainfall events in winter, reduced probability in summer.*
- *Significant reduction in snowfall. (NWCCIP, 2005*

Accidental Moorland Fires

Moorland fires are a major issue in the Peak District. They have a major negative impact on all of the significant features of the Peak District moorland – there are no positive impacts apparent.

Since 1976, there have been 345 accidental moorland fires in the Peak District – including many on National Trust land. There is a broad correlation with long hot summers and the number and severity of fires – illustrated in Figure 1. Each of the spikes in fires correlates with a long hot summer e.g. 2003, 1995, 1980, 1976 etc. The worst season on record was 1976, however a great deal of work to prevent and fight fires has improved the situation since then. An estimated 42 square km of moorland has been affected since 1976 – and more than 6 square km of peat is currently estimated to be bare.

**Figure 1: Peak District Fires since 1976.**




Bad years for fires coincide with dry summers (e.g. 1976, 1980, 1984, 1989, 1995, 2003).

All of these fires are caused by people – there are no recorded 'natural' fires in the Peak District. The main causes appear to be:

- Arson;
- Carelessness (cigarettes, camp fires etc);
- Controlled burns that get out of hand.

The impacts of fires can be significant in some circumstances:

- Direct loss of grazing animals and species of conservation interest
- Loss of vegetation and exposure of bare peat to erosion and drying out which can then cause increased water colour and sedimentation problems. The impact on water quality is significant for water companies and the costs of cleaning up the supply are high.
- Ignition and direct loss to the atmosphere of peat
- Loss in smoke and possibly water of heavy metal contaminants form the peat. These were deposited by industrial pollution.

The 'forecast' for trends in the risk factors for moorland fires in the Peak District appear to indicate that their incidence and severity is likely to increase in the coming years because:

- Increasingly, the vegetation and soil on the moors will be hotter and drier for longer in summer;
- The number of people present and consequently the risk of ignition will probably increase;
- Work to achieve favourable condition via English Nature on DEFRA's behalf will result in fewer grazing animals and less winter management burning. This is likely to result in greater mass of flammable vegetation available to fuel accidental fires.

Some of the climate impacts may increase the hazard – the likelihood of fire occurring - such as through increasing potential visitors numbers in the area. Furthermore, climate change has the potential to increase the inherent vulnerability of the moors to fire, for example, through desiccating soil and vegetation. Consequently, the combination of increased hazard and increased vulnerability will result in higher fire risk in exposed areas. Hotter, drier summers mean greater fire risk and hazard, due to:

- increased visitor numbers;
- decreased environmental capacity to resist fire;
    - soil and vegetation become more flammable so that fires ignite and spread more easily
    - reduced water supply to extinguish fires.

This is likely to result in greater loss of carbon to the atmosphere (NWCCIP, 2005).

Since the early 1990s, a strategic partnership approach has been developed between those key stakeholders with an interest in minimising the impacts of damaging accidental fires. This has involved the following key steps:

a. Prevention

- Fire risk monitoring and prediction
- linked to a staged response in terms of signage and response
- Raising awareness of the problems and the causes of fire
- Publicity
- Moorland closure during periods of extreme risk (not in recent years)

b. Preparation

- Preparation of fire plans for individual moorland which are shared by the main agencies
- Joint training and the development of specialist moorland fire fighting systems
- Purchase by the Trust and others of specialist all terrain vehicles, pumps hose and bespoke equipment
- Staged response of the Trust in response to increasing fire risk

c. Reaction

- fast response
- communication between the agencies
- use of helicopters as a first strike
- systems in place for major logistical response.

However, the severe events of 2003 have shown that this work is not enough to tackle the conditions that are increasingly likely in future. Further adaptation to the changing climate is required. Some of the ongoing projects on which the Trust and other partners are leading include:

- developing sustainable water supplies out on the moors. The most difficult and severe fires are in remote inaccessible locations. Water is usually some distance away – and the key to putting the fires out is to get water on them. One of the biggest challenges is therefore a logistical one – how to transport water to the fire. If we can develop a network of ponds and pipelines across the moors, this could increase the speed with which water can be delivered to the fire site. The cost should also be reduced. The use of helicopters can be extremely expensive. Over Easter 2003, landowners spent around £60,000 in five days on helicopters to help extinguish three simultaneous fires on Kinder and Bleaklow. Despite this some 8 square km of moorland were damaged. The water supply project will need to invest more than £100,000 in its first phase.
- as part of this water supply project, we are developing a moorland fire risk map to improve planning and prevention (in liaison with the Moors for the Future project).
- lobbying government to fund the use of helicopters to fight accidental moorland fires on access land. Currently, there is no contribution from the state.
- developing the partnership working to become more effective and efficient at dealing with the fires.

- developing new technology and equipment to improve fire-fighting techniques.
- working more closely with offenders in a new project to prevent arson.

Blanket Peat

The National Trust cares for around 5,000 ha of blanket peat in the Peak District. This deposit covers extensive areas of high plateaux and flat topped ridges of the area up to a depth of 4m. Peat is the accumulated remains of partially decomposed plant material that has slowly growth over the last 8,000 – 4,000 years. The peat resource of the southern Pennines is in places very degraded due to atmospheric pollution, fires, overgrazing and trampling damage. The degradation takes the form of severe gully erosion, sheet erosion and extensive bare areas devoid of any vegetation.

However, despite this the blanket peat resource of the Peak District is a highly significant feature for several reasons:

- it is a habitat type that is rarer at a global scale than tropical rain forest. It also plays a major role as a vast store of fossilised carbon. It also has the potential, when growth exceeds erosion / decomposition, to sequestrate carbon from the atmosphere.
- it is of international importance for its wildlife value.
- as a result of its long history, it represents a unique record of previous environmental conditions and human activity that can be interpreted from the evidence of buried pollen, animal remains and plant material.

Where erosion and drying takes effect, the remaining peat bogs have a major impact on water quality and water gathering. Firstly, bare peat is exposed to the effects of frost, wind and rainfall which release peat sediment into streams, rivers and ultimately reservoirs where it is often deposited. The reservoirs within eroding catchments gradually fill in and lose their capacity. This is obviously an issue if climate change reduces the amount of summer rainfall.

Secondly, as the peat dries out the processes of decomposition accelerate. Normally in a bog the conditions are waterlogged and the lack of oxygen in the saturated peat inhibit the activity of fungi and bacteria. On drying, the growth of bacteria and fungi is resumed. The by-products of this growth appear to be carbon dioxide, which is released into the atmosphere and, also a range of organic acids. These are released into the water supply when it rains following a dry spell – especially in the autumn – causing a flush of brown colour in the drinking supply. Water companies like Severn Trent Water are then required to treat and clean the supply using a variety of costly processes and additives. The slurry produced is then sent to landfill at further cost and damage to the environment. Water companies are currently reporting that the water colour problem is getting worse and will require heavy investment in new plant if it continues.

Again, as with moorland fires, the problem would seem to become more intense as climate change takes effect. Longer hotter summers will promote further drying out and vegetation stress leading to more erosion and degradation, particularly at the edge of gully systems. Wetter winters and more frequent intense rainfall events will lead to exacerbated erosion and transport of sediment / colour. The risk is that if no positive action is taken the peat bogs will increasingly become a major source of carbon dioxide adding to anthropogenic climate change.

A four year research project, funded by Severn Trent Water in partnership with the National Trust, Nottingham Trent University and English Nature, is currently looking at the impact of catchment management on water colour and erosion. This involves a four-year project to experimentally manipulate management impacts and closely monitor their effects. The Trust is producing detailed moorland management plans in liaison with its tenants, English Nature and DEFRA to restore habitats damaged by previous events and management. If we can restore the blanket peat to favourable conservation status they are more likely to withstand the climate changes. A key objective is to re-establish vegetation to bare areas of peat on Kinder and Bleaklow.

A key issue is restoring water table levels in the peat to enable peat building processes to resume. The Trust is undertaking, with some funding from DEFRA / English Nature, a number of experimental

gully blocking projects to raise water levels and re-wet the peat. If this proves successful then the work to block gullies will be scaled up across some extensive areas of moorland. Although this will be extremely expensive, it may be more cost effective to solve the problem at source rather than treating water supplies downstream. An added benefit is that if the peat bogs begin to accumulate and store carbon as a sink this will contribute to reducing atmospheric carbon levels.

The Trust and English Nature are working to reduce the intensity and extent of 'management burns' by grouse shooting interests on peat as this may have a major impact on water colour and erosion. Should catchment management fail to arrest the increased problem of water colour, the water companies will need to adapt to elevated levels by investing in treatment plants with higher capacities with the associated environmental and financial costs.

**Case study 4 – Climate change and gardens**

*Meeting the challenge of change in our gardens.*

The Trust published a joint report, *Gardening in the Global Greenhouse,* with the Royal Horticultural Society in 2001. A National Trust policy note is attached which addresses its practical implications in managing the countries most diverse and important collections of gardens that attract and inspire millions of people each year.

The challenge is well illustrated by Trelissick where some of the impacts of climate change seem positive. Positioned at the head of the Fal estuary in Cornwall, the estate commands panoramic views over the area and has extensive park and woodland walks beside the river. At its heart is the garden, which has year-round colour. The house is not open, but there is an art and craft gallery, shop, plants for sale, restaurant, café and a fine Georgian stable block.

The framework of the Victorian planting in the garden was greatly enriched by the Copeland family in the mid twentieth century, who developed an informal plantsman's garden with an extensive range of rhododendrons, magnolias, camellias, hydrangeas and woodland perennials and bulbs. Closer to the house, a rich mixed border exploiting Trelissick's mild climate is a distinctive feature of the place, as is the steep dell with its Tree Ferns, bamboos and bog plants. The garden houses the National Collections of Azara and Photinia.

For the last 25 years, the Head Gardener, Barry Champion has kept a record of the number of plants in flower on the 1st January. In 2005 the figure was 181 which compares with just 36 in 1997, suggesting a warming and change in growing conditions. Over the same period, Barry has noticed that the distinction between the seasons have become less marked, indicated by many summer flowering plants still flower in winter, along side the premature flowering spring plants.

Changing growing conditions have affected the management of the property. The garden traditionally opened on April 1$^{st}$ but is now open all year round, to give visitors the opportunity to enjoy early spring colour. This has a very positive impact on the property finances in both entrance receipts and the extra intake from the shop and restaurant. The more negative side of maintenance has included the need for lawn maintenance for 12 months of the year due to the moist mild Cornish climate. This can also provide an indication of what can be expected elsewhere in the country in the years ahead. Rain now comes in more intense bursts, causing paths to be washed out, necessitating a change in the character of the garden, as it moves away from traditional loose gravel surfaces to bonded surface paths, using concrete and crushed stone aggregates.

Though pests and diseases appear to be on the increase, the introduction of biological and organic methods of pest control keep outbreaks to manageable levels. Milder weather and a tendency towards less severe frosts in recent years, has allowed Dahlia and Canna tubers to be over-wintered in the ground.

Over the last 25 years or more, storms have been more frequent at Trelissick, resulting in tree damage and losses. In future, elsewhere in the country, mature trees of considerable age may be less common, especially on exposed sites, as increases in the frequency and severity of storms takes its toll.

**Case study 5 – Historic houses and interiors**

*Climate change impacts in managing historic places*

The impacts of climate change are being felt by the Trust in the management and care of our historic properties in many different ways.

Increase in storms and severe weather events: (causing flooding of basements, leaks through roofs, rainwater goods overflowing, damp penetration through window surrounds and walls) -

- direct water damage to plaster and decorative surfaces including plaster falls, paint flaking, disfiguration,
- mould growth affecting all organic materials, increased incidences of insect pest activity,
- corrosion of metal.

Hotter drier summers: (causing higher light and UV levels, lower relative humidity, changes in pollution levels, increase in dust levels, shift in insect habitat range)

- higher rate of photochemical damage to collections, including fading of dyes and pigments, and breakage of textile fibres from higher light and UV exposure
- shrinkage and desiccation of organic materials in dry conditions, including cracking of wood, and failure of adhesives for example in furniture joints
- higher dust levels impacting on level of housekeeping required
- insect ranges already shifting. Termites found in two sites in Devon (not National Trust). If termites become established in the UK they could have a devastating effect on wooden buildings. Range of some species of carpet beetles moving north in UK.

Milder, wetter winters: (damp and high relative humidity problems as above, increased level of insect damage)

- see above for impacts of damp conditions
- already seeing evidence of increased level of insect attack on collections. Carpet beetle, which live part of their life cycle outside are not being killed by winter frosts. More webbing clothes moth.

Many of these impacts are evident in the management of Blickling Hall, Norfolk.

Blickling Hall, North Norfolk, a Tudor house belonging to the Boleyn family, which was built between 1622-26, is but one example of a building with important contents that is already affected by climate change. The problems can loosely be categorised as flooding, damp, and brick erosion.

Blickling Hall lies at the bottom of a small valley. There is a stream approximately 300metres from the house. A severe thunderstorm in September 2001 caused the stream to burst its banks, and because of the lie of the land, the water had no direction to go other than towards the house. The usually dry moat was filled with water which flooded the basement rooms, including the original furnished kitchen which is part of the visitor tour. This flooding is linked with general issues of land use in the area. Poor agricultural strategies have meant there is little land to soak up excess rain water or stream overflow.

Damp has become a serious problem for Blickling Hall property and this is exacerbated by the nature of the building, which is designed as a figure of eight around two internal courtyards. The number of outside walls increases the problems of penetrating damp. One of the most affected rooms is the Jacobean Long Gallery which became a Library in 1745 and houses Sir Richard Ellys of Nocton's internationally important collection of books. The increase in the severity of rainfall, which has frequently overwhelmed the capacity of the rain water goods, resulting in over-flowing gutters and water running down the surface of the porous brick walls, has allowed water to penetrate the outside

wall behind the bookshelves. The damp conditions in the walls are favourable for insect pests such as death watch beetles, and their larvae have thrived in both the timber of the shelving and in a few cases in the books themselves. There have also been incidences of mould growth on the books.

The clock tower is also prone to damp problems, such as rot due to its wood construction as the photo shows. The water from the clock-tower drips through the rest of the house, causing problems to the ornate ceilings and compounds the impact of damp-related problems on the books.

Blickling Hall is taking part in the Building Knowledge for a Changing Climate group of research project funded by EPSCR (http://www.epsrc.ac.uk/ResearchFunding/Programmes/InfrastructureAndEnvironment/Initiatives/BuildingKnowledgeForAChangingClimate.htm). Within this group of projects, Engineering Historic Futures is studying issues arising from water damage to historic buildings, concentrating on developing appropriate methodologies for drying (http://www.ucl.ac.uk/sustainableheritage/research/HistoricFutures/). A basement corridor passing from the kitchen to the east wing is being used as a test site, since it is in one of the functional rather than decorative parts of the house. The 2001 flood exacerbated the long-term damp problems.

The final problem, which has already been mentioned, is that of the sandy brick construction of the house, which is not only porous, allowing damp penetration, but is also very susceptible to erosion. Increase stormy conditions results in the wearing away of this brick. This year £7000 was spent replacing a window and frame due to erosion exacerbated by heavier driving rain.

Many of the problems highlighted can be rectified. However, the issue of cost/benefit is difficult for the property manager to weigh up. There are many demands on limited budgets, and short term priorities, particularly those relating to compliance with legislation, such as the new Disability Discrimination Act, means that it is hard to find money to deal with longer term issues.

**Case study 6 – Lake District – drought**

*Facing up to dryer summers and drought in one of the wettest parts of England.*

The National Trust's main aim in the Lake District is the conservation of over a quarter of the National Park, including the land, houses, castles, gardens and countryside parks in its care. Almost all the central fell area and the major valley heads are owned or held on lease by the trust, 91 farms, twenty four lakes and tarns, and much of their shoreline are also fully protected. These 123,500 acres are about a quarter of the National Trust's entire holding.

The Lake District illustrates how climate change, leading to dryer summers, has caused drought problems.

The Lake District has over 160 private water supplies. Those properties that can be easily put onto mains water have been. For the others the costs of doing so, up to £200,000, has made it infeasible. The Trust as a private water supplier is compelled by law to provide its customers with water. If the private water supplies run out, it is the Trust’s responsibility to drive in reserves or even bottled water.

The dry summer of 2001 resulted in the drying up of some water supplies. Four properties in the area had to have water transported to them for six weeks. There was never an issue of people’s health being at risk, but it meant these households had to be extremely fugal with their water, and there were obvious hygiene implications.

Good adaptation and preventative action has been implemented. Over the last eight years better storage and a more efficient capture system has been put in place. Every property without mains water has storage of at least three days supply. Despite these plans problems have still occurred.

In 2003 a slightly different water related problem occurred. The Trust had to find a new water supply to cater for a caravan site, Strawberry Gardens. The caravan park and two Trust cottages previously

received water from Lake Windermere. However, water pollution in the form of blue/green algae, made the water potentially dangerous to consume. The exact cause of the algae is not know but it is likely to be caused by a combination of increase sewage in the water and warmer water surface temperatures partly caused by a warmer climate. The Trust was legally obliged to bring fresh water into the site for four weeks at a cost of £2,500 until an alternative source of water was found which cost £7,000 to install.

THE NATIONAL TRUST

Policy Paper

# CLIMATE CHANGE AND GARDENS

**Summary**

It is now National Trust policy that Climate Change awareness and planning is to be integrated within decision-making throughout the organisation. This paper is a response to this policy development, setting out the issues for gardens and parks, and a policy for managing Trust gardens in a climate of change.

**Introduction:**

The recommendations contained within this paper draw on the findings of the report on climate change and gardens: '*Gardening in the Global Greenhouse*', commissioned by the National Trust and the Royal Horticultural Society, published in 2001 (1).

Recent work by UKCIP & the Meteorological Office provides clear support and evidence that we are undergoing a period of rapid and accelerating change. This is affecting, and will continue to affect all Trust gardens and parks.

## 1 Background:

1.1 Examples of climate changes that have *already* occurred include: -

- the1990s were the warmest decade since records began in the1660s.
- annual summer rainfall has fallen by about 20% since late 19$^{th}$ century;
- the 4 wettest winters in SW England since records began have been in the last 10 years.
- a larger proportion of winter precipitation falls as heavy rainfall than 50 years ago.
- earlier onset of spring flowering; trees are coming into leaf on average 2-3 weeks earlier than 30 years ago.
- the growing season has lengthened by about a month since 1900 in central England.
- frosts have declined almost to zero in SW England and frozen waters even in N England are now very rare.
- Britain has become twice as stormy in the last 50 years.

1.2 Events of recent years illustrate the impact changes in weather patterns can have on the Trust's operations and the likely cost of climate change, should such events become the norm or accelerate in frequency and intensity.

1.3 Visitor patterns are changing, due to spring arriving as much as 30 days earlier. Extremes of rainfall and drought have had their impact, especially on plant health and presentation standards in gardens. The Great Storms of 1987 and 1991 resulted in the loss of an estimated 15 million trees over the SE, decimating properties such as Nymans, Emmets and Petworth, a repair bill of many millions of pounds, the loss of specimen trees up to four hundred years old, and in some instances, changed the character of gardens entirely. Storms at Cragside in the last five years have resulted in the loss of x% of the specimen trees in the arboretum and over xxx champions.

1.4 Recent flooding has had a devastating effect on many gardens e.g. erosion and damage, or the premature die-back of plant life due to the introduction of pathogens that flourish in wet or waterlogged soil. This has occurred at Westbury Court, where sections of 30-year-old yew hedges are now dying. Floodwater at Wallington demolished a fifteen foot high 17-century garden wall, caused extensive erosion of gardens paths and a repair bill of £XXX.....

1.5 In managing its gardens and parks the Trust's response to climate change will vary between 'prevent', 'adapt', 'mitigate', 'defend', or 'abandon'; responses that will have to be negotiated on a site by site basis, with a range of stakeholders.

## 2 CONSERVATION IN A CLIMATE OF CHANGE

2.1 The general approach to the conservation of gardens and parks as developed by the NT has focused on the protection of the 'significances' and 'spirit' of each place. Whilst change has been accepted as inevitable, traditionally, the aim of conservation has been to slow down the process of change in order to retain significances, such as historic layouts, features or planting effects.

2.2 Where major changes have been permitted within the NT's conservation ethos, they have been in response to an absence of historic precedents, or the need to increase visitor appeal, for labour saving, or to refresh planting within a garden's layout.

2.3 The Trust's conservation philosophy and especially that for gardens and parks (as set out in the Gardens Policy Paper 1996), has been predicated on the assumption that the environment, the climate and natural systems that enable all this activity to take place, will fundamentally remain unchanged for all time; a notion reflecting the Trust's remit, to hold property and land in perpetuity.

2.4 Despite fluctuations, such as near Mediterranean conditions in the Middle Ages and a 'mini ice age' in the 17c, the *climate* that Britain has enjoyed during the last 400 years, and continues to enjoy today retains a temperate, maritime one. The relative stability of our climate has provided the conditions in which most of the gardens now in Trust care were created.

2.6 The climate change scenarios for this century however suggest our climate will change more rapidly than in the last xxx years. These changes will fundamentally affect the growing conditions of the cultivated plants that make up majority of a garden's content, impacting directly on the range of plants that can be grown and thus on the character and conservation of a garden.

2.7 Attempts to arrest such changes are likely to require increasing levels of resources, to the point where this may well be deemed unsustainable.

2.8 With climate change factored into conservation, we therefore accept that it will not be possible to preserve/conserve gardens and parks, their layout, character, characteristic plantings, or their associated plant collections entirely unchanged. Nor might it be possible in future to recreate past layouts, when the climate that supported those features has by then become historic.

2.9 For gardens, conservation in future will be as much, if not more, about managing change, as it will about conserving a garden's historically significant layout, details and characteristics.

2.10 Climate change will impact on many of the NT's long-term conservation aims for gardens and parks, thus, it is only right that plans are put in place, to guide their management through the changes that the future is likely to bring.

2.11 Doing nothing is not an option.

## 3 ADAPTATION

3.1 The following principles and guidelines are recommended for managing historic gardens and parks in a changing climate:

- The Trust philosophy of conservation for gardens and parks must evolve, to embrace the inevitable and far reaching environmental changes that are likely to occur. It must become more pragmatic, pioneering and innovative in adapting to change, but should also be opportunistic and economical with resources.

- The Trust will generally strive to do everything it can to conserve its collection of highly significant gardens and parks and their special character and layout, provided it is willing to dedicate the necessary resources, and the result does not increase the impact of Trust operations on the environment.

- The Trust will be more flexible in its approach to its less historically significant gardens and parks, and will generally go with the flow of nature.

- When any gardens and parks or their associated plant collections are at risk from climate change, e.g. from flooding, and might require heavy, repeated investment, the NT will generally work with the grain of natural processes (See NT's general Climate Change Policy Paper RJ?. Intranet sitexxx).

- In all cases, the Trust will adopt and seek to develop pioneering or innovative maintenance techniques to help it meet these challenges.

- Reasonable effort will be made to conserve important plant collections in situ, by adopting good husbandry practices to ensure all plants are in best health to withstand climatic extremes (See NT Gardens and Parks Plant Conservation Policy paper....).

- Where this proves increasingly difficult or the expense cannot be justified, considerations should be given to moving important collections of plants to more suitable locations with the same garden (see item 'Planning for Climate Change..'...below). Should this solution not be acceptable, then an alternative, host garden should be considered, in another area or region, where the collection will supplement and enhance the spirit of place and any botanically or historically important genetic material will have the best chance of survival.

- Where historic, structural planting needs to be replaced, e.g. formal avenues, clumps etc, but is dependant on species unable to adapt to rapidly changing climatic conditions - consideration should be given to using species more likely to adapt or cope, that will give as close to the original effect as can be achieved.

- Where entirely new planting is being considered (e.g. for car parks), consideration should be given to species more likely to cope with rapidly changing climatic conditions.

- Collections and arrangements of ephemeral plantings, e.g. annuals, biennials, bulbs, herbaceous perennials and some shrubs should evolve naturally, in response to changing climatic conditions, provided the selection of new material is in tune with the spirit of place and not hungry of natural resources, e.g. requiring water for irrigation.

- Water bodies, lakes, ponds and canals etc, should be maintained in layout and appearance as originally intended, provided the necessary resources continue to be made available. Where this proves impossible, alternative functions should be considered. Management should work with surrounding landowners to protect water catchment supplies and to prevent siltation and algae blooms arising from run off into ornamental lakes

- The Trust will not generally rely on mains-fed irrigation systems to maintain ornamental lawns in gardens, though may use harvested water supplies.

## 4. MITIGATION

4.1 The NT should do all that it can to reduce green house emissions, arising out of managing and opening it's gardens. The Following are some of the areas in which positive contributions can be made towards reducing greenhouse gas emissions arising out of the management of Trust gardens and parks. For full guidance on the Sustainable Management of Gardens and Parks, please refer to the Sustainable Practices Guidance note on (Intranet site..)

- Adapting garden machinery and heating glass houses and out buildings with 'Green' sources of energy.

- Sourcing supplies and materials locally, in order to reduce transport emissions

- Harvesting water from roofs and other for the irrigation of lawns and borders

- Switching to 'Green' sources of electricity

- Managing gardens and plant collections in a way that is not over demanding of natural resources

- Composting as much garden waste material as possible, to avoid transport to land fill sites

- Reducing visitor related green house gas emissions, by encouraging green transport, car sharing etc.

- Planting shelter belts with species more likely to withstand climate changes (as has taken place at Sheffield Park), or acquiring additional land to make this possible, where additional shelter is vital (as at Glendurgan)

## 5. PREPARING FOR CLIMATE CHANGE

5.1 Property Managers and Head Gardeners are asked to consider the likely impact of the following climate change scenarios on properties for which they are responsible and how they might respond (for full details of the climate change scenarios, please refer to *'Gardens and the Global Greenhouse'* NT Intranet site.....)

- UK temperatures rising by 2 - 4%c over the next 80 years
- 42% c to be exceeded once a decade in lowland England
- wilder stormier weather
- less frosts
- more frequent, heavy rains
- snow fall decrease by 90%, especially in the SW
- regular droughts, especially in the SE
- earlier flowering
- longer growing season - 3 weeks in the south and 10 days in the north.
- More incidents of pests and diseases
- Fresh and sea water flooding

Note: a 1%c rise = 200k shift in climate, this being the equivalent of Marseilles moving to Maidstone.

5.2 Guidance on costing the impact of climate change on gardens and parks can be found on the Trust's Intranet (location tba). The process as described will help property staff establish the costs of mitigating and adapting to climate change and in planning for the changes in the way gardens and parks will have to be managed in the 21c.

## 6. MANAGING CHANGE IN GARDENS AND PARKS

### 6.1 Recording

If the changes a garden or park faces are likely to alter its significant characteristics, then these should be recorded before changes take place. This particularly applies to the important layouts, planting traditions or plant collections; the latter should be recorded and assessed as a priority, and a strategy drawn up for each property, to ensure the conservation of as much significant genetic material as possible, for the benefit of future generations.

### 6.2 Planning

Changes in gardens should be discussed with the relevant Curator and Gardens and Parks Adviser and if likely to be significant, submitted to the Gardens Panel for consideration. (See Policy paper *'Major Changes in Gardens'*).

6.3 Each property's strategy and approach to climate change should be set out in the Property Management Plan, and Garden and Park Conservation Plan.

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