Tackling Climate Change: local planning for a global crisis

Climate change is the biggest long-term threat to our prosperity and well-being. The benefits of strong and early action far outweigh the economic costs of not acting and intelligent geographic information is a key tool.

Whilst many of us want to do something about climate change, taking action is easier said than done. Distilling the solutions of a global problem to a local level is very difficult and even more so when the impact of change will be felt over a long period of time. However, now we are seeing very real evidence of this impact on our very doorsteps in the form of unseasonable weather, drought, tornadoes, high rainfall and flooding.

The government through the Sustainable Energy and Climate Change Act 2006 is committed to producing an energy measures report. This report will contain information on measures that local authorities can take in order to improve energy efficiency; increase the levels of micro-generation; reduce greenhouse gas emissions and reduce the number of households living in fuel poverty. Local authorities will have to consider this report when exercising their functions.

Whilst the report will focus on emissions reduction and fuel poverty measures, it will also make clear the link with adaptation to climate change. This has been further emphasised through DEFRA's Joint Environmental Prospectus with the Local Government Association, released in July 2007, setting out how councils can take leadership in addressing climate change through three environmental aims:

- Tackling climate change
- Protecting the natural environment and resources
- Improving the local environment.

Through the Climate Change Bill, government is requiring a reduction in CO_2 emissions for local authorities of between 26 and 32 percent by 2020 and 60 percent by 2050; against a 1995 benchmark. With ambitious targets like these and challenges set at the strategic and local level, local authorities need more intelligent means of measuring, monitoring and managing improvements in their efforts to tackle global warming.

The Environmental Prospectus sets out the three high level environmental aims and key actions and these will be reflected in the new performance frameworks for both local and national government.

This paper focuses on those aims that have a geographical component and can be assisted by the use of intelligent geographic information. The key areas of focus are listed below in Table 1.

Barriers to use of geographic information

Geographic information underpins all our planning activities and interactions with the environment. There currently exists some information available to local authorities but by no means enough to accurately assess the scope of the issues and support responses to a global climate change programme at a local level.

Lack of intelligence - Information on land usage, open space, detailed terrain information, energy loss potential are all missing from National topographic mapping currently available to Local and Central Government departments; key environmental response planning cannot be undertaken.

Lack of detail - Terrain data at the National level is only available at rather coarse levels and more detail data is limited in coverage. Databases are often out of date and composed of multiple surveys so reducing the validity of any final derived analysis

Limited models - National mapping provides details on the geographic location and address of properties, but there is limited data available on the use, age and structural type of the building so hampering energy monitoring

Environmental AIM	ActionsRequired	Signs of
Tackling and adapting to climate change	Reducing energy consumption Planning for future on the basis of a changing climate Preventing fuel poverty, increasing energy efficiency in social housing Mitigating the impact of flooding in local plans	CO2 reduction in Local Authority buildings Community resilience Reductions in Fuel poverty Community resilience
Protecting Natural Resources	Managing open spaces to provide high quality environments Use local strategic plans to deliver land use priorities Recognising value of living environments in regeneration policies	Improved local environment and biodiversity
Improving the Local Environment	Strategic planning Engagement with citizens Improving local environmental quality	Improved local environmental quality

Table 1 High level aims and actions required as set out in the DEFRA & LGA Joint Environmental Prospectus July 2007

	Description of Work	Comment
Phase One	Geographical data audit • Build geographic resilience	Contact a specialist GIS consultant to have a review of your GIS databases to see if they are able to provide you with the information required to fight climate change
Phase Two	Geographical skills review • Build staff skills	Review your skills set, perhaps it needs topping up with some training course or in house consultancy with specific actions on supporting climate change programmes or even training on some new geographical datasets.
Phase Three	Project identification • Focus on achievable projects	Identify key projects that can create, in the short term, realistic benefits, such as a thermal survey, an open space database or a flood risk model. Projects should be definable and ones that can gain funding.
Phase Four	Sustainability programme • Develop future growth programmes	Create a programme that the data and skills created are maintained and resilience is built up. The fight against climate change will not be a short one and it is not only data that needs maintenance; people do to.

Local and central government will have to show leadership in the fight to reduce carbon emission

programmes and energy conservation planning.

Lack of detail on open spaces and neighbourhood profiles - Local development plans and national mapping do not contain detailed information on the local extent and make up of open space areas. This makes it difficult to develop an overall consistent picture of land use which is required to create high quality environments to cure local area deprivation.

In conclusion users are data rich but information poor; knowing 'where' is only half the equation, knowing 'what' in an environmental context is critical to solving local responses to global climate change.

Geographic Intelligence

To meet the targets on our commitments to reducing CO_2 emissions action is required at the local level. To do this geographic information is required at the local level to enable planning and responses on not only a neighbourhood level, or a street level but down to a house level. Not only must this data be accurate at the house level but it must contain a rich set of geographic information to enable real planning and decisions to be made.

Energy Efficiency

Fig 1 - Thermal aerial mapping - different colours for relative heat loss from buildings. Red and orange are high, yellow is average and green and blue is low.

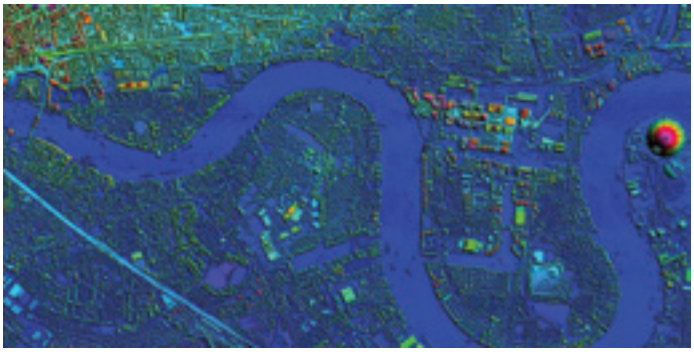

Fig 2 - LiDAR imagery showing ground and surface features colour coded by their height above sea level.

One key area in the fight to reduce carbon emissions is the reduction of energy emissions from buildings. Thermal aerial surveys that measure heat loss (either absolute temperatures or relative temperatures) provide a very quick (a whole city can be flown in one night) and effective way to gather accurate information on heat loss (heat loss is converted into a temperature value for every building for direct comparisons). See Fig.1 as an example of thermal aerial mapping.

Once this information is gathered heat loss and CO_2 emissions can be calculated (if absolute temperature is measured) or relative heat loss measure and management plans drawn up for properties.

Where additional information on the property is known, e.g. use (commercial or residential), age(Victorian or modern), or type (detached House or tower block) more specific energy conservation plans can be drawn up targeted at the specifics of the building, so leading to more intelligent, targeted and cost saving campaigns. The effectiveness of energy conservation campaigns can be measured with successive aerial thermal surveys.

Flood risk planning

Adapting to an inevitably changing climate will be required and planning at the local level will be necessary. Many of the requirements on Local authorities are set out in PPS25 (Planning Policy Statement 25: Development and Flood Risk) making authorities responsible for mitigating flood risk through Strategic Flood Risk assessments.

Two million homes are at risk from coastal or inland flooding; this is equal to approximately 10 % of total homes in the UK. Around 400,000 homes are at very high risk of flooding (greater than 1.3 % annual probability which is about a 1 in 75 year recurrence). This number is set to rise from 2 million to approximately 3.5 million.

Detailed terrain models that measure the height above sea level of the ground and all the features on it to an accuracy of ±15cm are now available. These data are accurate to a level that is not currently available to local authorities on a national level and may require a new survey to collect it.

An airborne data collecting sensor, LIDAR (Light Detecting And Ranging) uses a laser beam to measure the height of features below the aircraft - see Fig.2. The LiDAR data can be processed to give:

- A Digital terrain model, (DTM) revealing the heights of the bare ground and even ground underneath vegetation
- A Digital Surface model (DSM) revealing the heights of all the features on the surface, buildings, walls, trees etc.

The combination of both these digital models can give us a very detailed picture of the exact height of houses, gardens, bridges and heights of river banks. These data can be used within SFRA's to deliver responsibilities to meet PPS25. This detailed data can be fed into flood prediction models combined with land use mapping to support analysis and it can be processed to give a detailed view of which buildings will be affected.

Creating High Quality Environments

There is a known link between local deprivation and local green space. Open space or green space are seen a key indication in the quality of our environment. Local plans provide some information on open and green spaces, but not enough.

Early studies in Glasgow have proven combined population statistics and open space mapping to calculate the percentage of people that live within reach of an open space. Detailed information can be gained from land use and open space mapping using, aerial imagery and field studies.

Information can be gained on the general land use, such as residential, gardens, and the built environment. But in addition to this open spaces identified at a general level can be further sub divided to identify type of green space, such as amenity land, parks, sports pitches, mixed use green space, parks etc. - see Fig.3.

This information is not available in Ordnance Survey mapping. But when combined with it can prove a very powerful planning tool to support policy making. Key statistics can be derived on: the percentage of green space to built land, the locations of green space, identification of green space corridors and potential land that could be converted into green space.

National classifications exist with PPG 17 in England and Wales and Pan65 in Scotland. By using databases designed to such criteria it is not only possible to analyse space on a local level but on a national one as well.

Engagement with citizens

In the challenges we face in global climate change, councils will be expected to show leadership. To do that they will be expected to engage with communities, create trust, and in certain circumstance make difficult decisions. All this will only be possible by sharing information. This can be undertaken in many ways, but perhaps the most trusting and powerful way is through the provision of maps and images.

Here geographic information can play a crucial role in demonstrating action plans and proposing complicated scenarios for local areas in a very simple way. Mapping enables communities to see in a transparent way the plans councils have and to associate with these very easily.

Geography can engage communities in so many ways:

- Heat loss maps can show houses or communities that may be able to seek financial support for roof insulation, or support to reduce fuel poverty.
- Land use maps can inform developers and communities about possible ways to better use local land
- Flood risk maps can show areas of the community at risk and evacuation plans in the event of flooding.
- Aerial photography provides an immediately engaging image of a local area onto which plans can be overlaid.
- Easy identification of green spaces, 'hidden' local open spaces can be revealed as can healthy options for cycling or walking to work.
- Urban regeneration areas can be identified and communities can be engaged over plans to transform local areas

Fig.3 An example of green space mapping, identify green space and the type of green space on Ordnance Survey Mapping

Global Climate Change

Climate change is the biggest long-term threat to our prosperity and well-being – managing the threat requires a radical de-carbonisation of the economy, and massive technological change away from the use of fossil fuels. This is not only about large-scale action at international and national levels, but local and individual action too.

The scientific evidence on climate change is now compelling. The reports of the UN Intergovernmental Panel on Climate Change have set out the scientific consensus. Atmospheric carbon dioxide levels are currently at 430ppm CO_2e (carbon equivalent). On a business as usual scenario, emissions will reach 550ppm CO_2e by 2035 – at which, global temperatures are predicted to rise by at least two degrees. Keeping temperature rises to two-three degrees is considered to be essential if we are to avoid dangerous climate change, so we need to keep emission concentrations at the 550ppm level.

Climate change is an economic issue. Sir Nicholas Stern's review on the economics of climate change concluded that "the benefits of strong and early action far outweigh the economic costs of not acting". He has estimated that if we don't act, the costs will be in the range of 5-20 per cent or more of global GDP each year, whereas the costs of reducing greenhouse gas emissions to avoid the worst impacts of climate change would be around 1 per cent of global GDP by 2050.

And a social issue too. Research and experience tells us that the poorest communities are and will be disproportionately affected by climate change. Leadership on climate change can be located alongside leadership to tackle poverty in particular fuel poverty, and water security, and the promotion of social justice.

So we need to use less energy, use energy more efficiently, find alternative energy sources and neutralise carbon emissions where fossil fuels are used, if we are to stabilise the climate. We also need to adapt to and plan for a changing climate.

Geography through the medium of maps and aerial images can enable councils to improve services to their customers by opening up information in a way that can be readily understood. In the fight against global warming and as a means to prepare our communities for the inevitable changing climate geography is a key tool to communicate, inform and interact at the local level.

Conclusions

Whilst there is still uncertainty about how we can best tackle climate change there is one thing that is certain, we are going to have to face up to a changing climate. Local authorities and planning bodies face paradoxical challenges in the coming years. The government's targets, set out in its housing green paper, are to increase house building by some 80,000 additional new homes a year until 2020. Yet many of these can and will have to be built in areas at risk of flooding.

Geography in the form of land use mapping, terrain modelling will be crucial to having the right information to hand when planning local responses to these conflicting challenges. However as with all data, that geographical information should be accurate, timely, and intelligent and, above all, fit for purpose.

Geographical information can and should be at the heart of any action plan whether local or national in the fight to reduce our carbon emissions and mitigate the effect of a changing climate. This paper is intended to stimulate thinking and support actions to tackle the issues through the effective use of intelligent geographic information.

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