Report

Sustainable Development Commission

Know your environmental limits

A local leaders' guide

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Acknowledgements

Drafting team

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Foreword

'Living within environmental limits' is one of the five principles of sustainable development, as set out in Securing the Future, the UK Government's sustainable development strategy, published in 2005. But the practical meaning of 'living within environmental limits', and our methods to achieve it, have not yet been articulated clearly. It is easy to talk about environmental limits, and many of us accept that such limits must exist. But how do we recognise them? How do we know when we're bumping up against them? And what can we do to prevent those limits being breached? This is where the re-energised focus on local decision making is both a fabulous opportunity and, potentially, a cause for concern. A lot of limits don't make sense at very local levels, but local actions can, collectively, lead to environmental problems in other areas.

There has been a lot of positive action on sustainable development at the local level. Increasingly, local leaders face many competing pressures and are charged with doing more and more with less and less, so it essential that we use our limited resources wisely. Sustainable development, and living well within environmental limits, gives us the framework to rise to these challenges.

The Sustainable Development Commission (SDC) recognised the gap in understanding 'environmental limits' at a local, practical level and we set out to support the UK Government in developing a clearer set of principles for embedding environmental limits in a wide range of land use planning documents and policies. This document is intended to provide an accessible summary of our research to date. It assembles practical guidance to assist local leaders in recognising environmental limits, and in taking steps to help their communities live well, within these limits.

This guide, principally intended for local governance bodies and community groups, does not present an exhaustive list of the issues we need to consider. Nor does it attempt to provide definitive answers for each of the issues. It does provide a strong context for why and how to begin the process, and highlight the inherent linkages between our natural environment's assets. We have consulted with colleagues both within and outside of government in compiling our key considerations for local action based on the current state of play and what we can expect from the future.

This is not work to be undertaken solely by local leaders, although many of the tools and skills necessary are already available. The SDC's challenge to central government is to support local leaders in taking these first steps, and to monitor collective progress. By considering our local environment as greater than the sum of its parts, and in its national and international setting, we can all begin to benefit from the significant wellbeing improvements and efficiencies gained by living within environmental limits.

Alice Owen
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1. Environmental limits - Main issues and definitions

The natural environment encompasses all life on Earth and the physical systems that enable that life to exist. These systems interact in complex, sometimes unknown, ways to create and sustain the world that we know, from weather systems to the diversity of plants and animals. We depend on these systems and the life around us for our very survival. We also have an impact upon them. A healthy environment provides us with a clean supply of air and water, food, raw materials and disease regulation. Together, the benefits to us of experiencing, appreciating and enhancing the environment are multiple, although often immeasurable; they include individual health and wellbeing through to public expenditure savings. These benefits that the natural environment provides for us are increasingly known as 'ecosystem services',[1] a term applied to recognise and even economically value their worth. But the environment is not just here for our benefit, and besides, the extent to which it can continue providing these services at the current rate is limited. We therefore must take seriously our stewardship role, for the sake of the natural environment itself, and for the wellbeing of future generations.

Environmental resources are finite and often fragile. Environmentally damaging behaviour and competing pressures on land for food and development, in the context of increasing population and consumption rates, reduced public spending ability, and climate change, means that the quality and productivity of our environment is under threat. With one of the highest European population densities for land available, England should be all too aware of such pressures.[2] And the greater the pressure, the less able the environment will be to sustain its natural systems and continue supporting our quality of life. This does not mean that we must stop all future development, rather that we must consider the effects of that development and how we can adapt our actions to not only conserve but actually enhance the environment. In short, our development must be sustainable.

1.1 Understanding our impact on the environment

The 'Pressure-State-Response' framework (Diagram 1), introduced by the Organisation for Economic Co-operation and Development,[3] is a useful tool for examining the various ways that human activity affects the environment, the impact this has, and the decisions and actions we can take to improve the situation.

1.2 Sustainable development and environmental limits

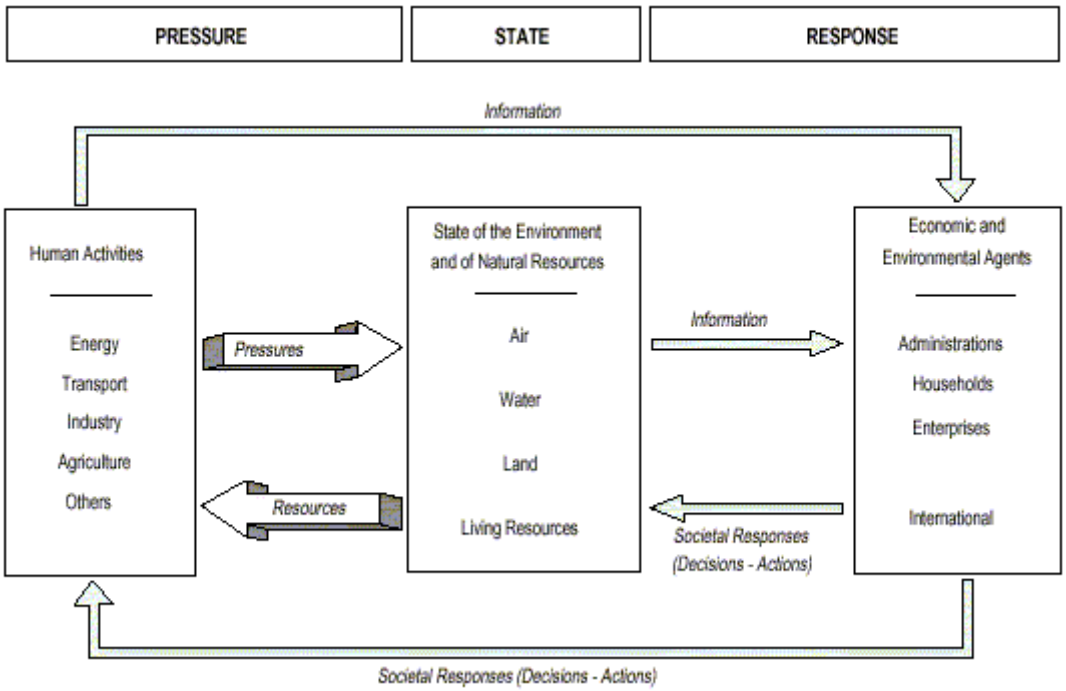
When responding to detrimental changes in the state of the natural environment, the Sustainable Development Commission (SDC) believes we must take a sustainable development approach that ensures progress towards a strong, healthy and just society and protects the quality of life of future generations. Only this way can we provide lasting solutions to environmental problems. Actions that breach environmental limits cannot be sustainable, but neither can initiatives which respect those limits but are socially divisive or economically unviable. An essential step in responding to environmental change is to understand the limits that exist within the environmental system and therefore when and how to take action. The SDC defines an environmental limit as:

> The critical point(s) at which pressure on a natural resource or system creates unreasonable or irreversible change to the resource or system itself, to the detriment of the humans and other organisms to which it provides a service.

The dynamic nature of environmental systems and the complexity with which they interact often means that limits can be difficult to quantify. In some cases all that is possible is to identify degrees of vulnerability for habitats, species or services as data may not be available

Diagram 1

The Pressure-State-Response framework[4]



and cumulative impacts not yet understood. Where there is any uncertainty over the accuracy of an environmental limit, the *precautionary principle*[5] must be applied, i.e. action should always be taken to ensure that human activity operates well below the limit where there is a risk that breaching the limit will bear unknown consequences. Decision-makers must ensure that the environment and the public are protected from harm, and these protections can then be relaxed, for example if scientific evidence shows that limits are further away than predicted.

1.3 Think global, act local

Different environmental issues have different geographical patterns which affect the distribution of services and impacts. These can be global, such as the regulation of the climate system; regional, such as the availability and distribution of fresh water; or local, such as a unique landscape that has cultural significance to the local community. Regardless of the scale of the issue, international and national legislation quickly translates to local priorities and standards, with huge importance to local communities. With spatial variations in population density and the proportion of land that is developed, particularly between urban and rural areas, the local context becomes all the more relevant.

Furthermore, local environmental infrastructure networks play an important role in managing human pressures on the environment and safeguarding communities. These networks treat and deliver our clean and waste water, provide our energy, manage flood risk and deal with our household waste, among other things. To avoid breaching environmental limits, a key challenge for local decision-makers and infrastructure providers will be to ensure that sufficient capacity and the right kinds of facilities are in place to meet both growing demand and wider environmental pressures.

Our consumption and behaviour has significant impacts on global environmental resources and systems – through our environmental or ecological 'footprint'[6] - but the purpose of this guide is to help recognise and live within environmental limits in our local areas. It is important that we take responsibility, both

individually and collectively, for our impact on the natural environment and take action that is effective and reflects the needs of the community.

1.4 How can this guide help you?

This guide is designed to raise awareness of the need to respect environmental limits and highlight the roles that individuals, communities and different organisations can play to ensure positive outcomes for people and the natural environment. Its role is to assist people to ask the right questions when considering issues relating to the development of their areas and provide guidance for getting the answers we all need if we are to make effective and efficient decisions for our long term future.

Section 2 will apply the 'Pressure-State-Response' framework (see Diagram 1) to highlight the pressures on, the state of and the current policy response to the following set of environmental issues in turn:

1. **Air quality**
2. **Biodiversity and habitat quality, quantity and connectivity**
3. **Climate change**
4. **Noise and light**
5. **Water**
6. **Soils**
7. **Land use.**

This is not an exhaustive list, but covers what the SDC believes are some key areas of concern. Some of the issues have limits set in legislation or policy - for example carbon emissions and air pollutants - but many do not, despite being essential for maintaining a natural balance in the environment. The SDC recommends that setting environmental limits for each of these issues should be our initial response - and in some cases this may be a step best taken first at the local level.

It is important, however, that these environmental issues are not considered in isolation. They form part of a greater system, interacting with and influencing each other. There will often be challenges in identifying and tackling cumulative and cross-boundary impacts and limits at the local authority level, and tensions between the different priorities of local groups. Such issues may lead to contradictory strains on the natural environment. In order to reconcile these differences and live within environmental limits it is crucial that we understand how all of the environmental issues listed above connect intrinsically and impact on each other. We need to think long term, often to work in partnership, and cannot look at each issue in turn or we will miss the wider picture of the natural environment.

Diagram 1 is intended to show these connections and provide clarity on how we can consider the whole. Through asking the right questions and planning for multi-functional land use, local leaders can deliver the seven key support elements for a healthy natural environment (the inner seven circles of the diagram). In turn, each support element can enhance the quality of the others (as shown by the colour-coded outer level circles of the diagram). The diagram demonstrates that better outcomes can be achieved by improving the quality of *all* of the elements, at the same time.

Section 3 proposes actions for community groups and local governance members and bodies to take to improve the current state of their local environment, now and for the future.

Diagram 2

Key support elements for working towards a healthy natural environment

1 Has planning minimised GHG emissions?

2 Has planning minimised the cumulative impact of air pollution?

3 Is there space for water to flow and be treated?

4 Are there plentiful high quality, connected green spaces and protected areas?

5 Has soil sealing been minimised to leave natural land cover?

6 How near are roads and industry to green space and the places people live?

2. Categories for environmental limits

As Diagram 2 shows, we need to consider the whole of the natural environment and its limits, not just its constituent parts, in order to ensure we develop sustainably.

Important recent research is providing crucial evidence to enable us to make better decisions in this way - including internationally through *The Economics of Ecosystems and Biodiversity* project,[7] and the forthcoming *UK National Ecosystem Assessment*,[8] the first analysis of the UK's natural environment in terms of the benefits it provides to society and the economy. However, the SDC considers that the concept of environmental limits needs to be recognised across the board, that central government must now take the lead to bring it into mainstream thinking and policy development, and that local governance bodies and community groups must understand and take limits into account in their own local plans.

First, we need to understand the background to each of these issues in terms of the pressures upon them, their current state, and the existing national policy 'response' to protect them. Section 2 sets out a summary of some of the key current pressures, states and responses, along with a snapshot of any existing or potential limits, for each issue in turn. Once the context for each is clear, a locally-relevant response can be designed which integrates and mutually benefits them all.

The environmental issues are set out in alphabetical order, with the exception of the final two – Soils and Land Use. The SDC considers these to be issues upon which little or no action has been taken to recognise limits and apply regulation or legislation, or simply that awareness of the importance of these issues is low. These are still crucial areas for action, particularly given their implicit connection to the other issues.

2.1 Air quality

Clean air is essential for supporting life on Earth by enabling animals to breathe and plants to photosynthesise. Limiting the pollutants in the air to acceptable levels is necessary to support good health.

Pressure

Air pollution results from human activities related to burning different types of fuel such as coal and petroleum products, and emissions from industrial processes or transport. It can also come from (global) natural sources, such as wildfires and volcanoes. No matter the source, if increases in atmospheric pollutants exceed safe limits, action must be taken. Pollutants can be classified as primary if they are directly emitted from a source, such as carbon monoxide from a car, or secondary if they are formed from several pollutants reacting in the atmosphere, such as ground level ozone.

Negative impacts of air pollution on the natural environment are often multiple and complex, depending on the type of pollution and the lifecycle of the particular species or habitat. Air pollution can therefore lead to indirect effects due, for example, to its negative impacts on the nutrient status and acidity of soils and water. The impact of air pollution is also felt on the built environment and is particularly damaging to older historic buildings, which are often important to local identity. But the most obvious negative impact is that on our health.

State

Although huge improvements have been made in air quality in the UK, air pollution is still causing problems for both human health and the natural environment. Health impacts of air pollution include respiratory problems, allergies, and heart and kidney disease and are currently estimated to reduce the life expectancy of every person in the UK by an average of 6 months.[9] The UK's annual report on air quality in 2009 stated that we were still exceeding limit values for a number of pollutants across much

of the UK. For example, we exceeded the annual mean nitrogen dioxide limit value in 40 out of 43 zones into which the UK is divided, and the long term ozone objective for human health was exceeded in 39 zones.[10] Furthermore, we have exceeded the critical load for acidity in 58% of the UK's natural and semi-natural habitats assessed between 2004 and 2006, and nutrient nitrogen deposition was exceeded in 60% of the area.[11]

Response

The UK Government and devolved administrations have set air quality objectives based on scientific and medical evidence on the effects of pollutants on health and the wider environment, as minimum or zero risk levels.[12] Many of these objectives mirror the legally binding limit values in EU legislation.[13]

Local authorities in England have a legal duty to tackle air quality. They are required to assess air quality in their locality and declare local Air Quality Management Areas (AQMA) if they identify problematic pollution levels and implement an action plan to address the issues.[14] It is important that planning and regulatory authorities ensure that infrastructure such as new roads or developments do not cause further breaches of limits to protect ecosystems from air pollutant deposition or ambient concentrations.

Existing legislative limit

EU limit values exist for particulate matter (PM_{10} and $PM_{2.5}$), Sulphur dioxide, Nitrogen dioxide, Lead, Carbon monoxide, Benzene, Ozone, Arsenic, Cadmium, Nickel and Polycyclic Aromatic Hydrocarbons.[15]

2.2 Biodiversity and habitat quality, quantity and connectivity

Biodiversity is the term used to describe the wealth and variety of life on earth – its plants and animals (including us) and their habitats. As well as having an innate right to exist, this life provides us with many vital services for our own survival, known as 'ecosystem services'. Perhaps most obvious are food, water and fibre. But the services provided to us by biodiversity extend well beyond those which we grow and reap, and a healthy natural environment is a complex and interactive system we depend on for our lives, health and identity. Not only must high-quality habitats be maintained and enhanced to avoid species loss, but they must be well connected. By restoring functional connections between habitats we can avoid the 'fragmentation' which threatens populations and individuals through isolation.

Pressure

Humans impose many pressures on biodiversity and habitat quality, quantity and connectivity. These can be classified under two major groupings:

- **Development** – as we damage and pollute the environment and remove or fragment habitats through construction, industry, farming and travel, we not only reduce the environment's ability to support a variety, abundance and range of species, and to produce food, but also its ability to regulate water and air quality, and to store carbon. We also lose the subtlety and distinctiveness of natural landscapes which help to give our local areas and communities their identity
- **Consumption –** demand for natural resources such as food, water and fibre is increasing. We are currently consuming some natural resources faster than they can be replenished and it is estimated that global demand could grow by 70% by 2050.[16] Global water demand is projected to rise by 30% by 2030 and global energy demand by 50% by the same year.[17] As demand rises we outstrip resources and put crucial habitats and species under threat. It is now well known that if the rest of the world consumed the way we do in the UK

we would need 2.75 planets to sustain our lifestyles.[18]

State

Defra uses a set of 26 indicators, comprised of 36 individually assessed measures, to provide an overview of the state of biodiversity in England. Of these, 18 (50 per cent) show an improvement; seven (19 per cent) show little or no overall change; eight (22 per cent) show a deterioration; and for three (eight per cent) there are insufficient data.[19] Farmland and woodland bird populations – recognised as good indicators of the broad state of wildlife[20] – have fallen by 52 per cent and 24 per cent respectively since the 1970s.[21]

Furthermore, across the UK, national and local Biodiversity Action Plans (BAPs)[22] monitor and report the status and quality of species and habitats identified as conservation priorities in light of their threatened status. BAP targets are set at the local – usually county – level for the number, condition or extent of habitats which should be maintained, restored or created; and the range and population size of species. In the last round of reporting in 2008, increases in the number or extent of some of these priority species and habitats were reported. However, 19 priority habitats (42% of the total) and 88 priority species (24%) were assessed as declining or probably declining, and eight priority species are reported to have been lost since the BAPs began in 1994.[23] In losing these habitats and species, we are affecting the environment's ability to support us.

Response

The recent '*Lawton Review*' (2010) called for a new approach to protected areas to achieve an overall objective of a coherent and resilient ecological network (more, bigger, better, joined).[24] The SDC agrees that this would be a vitally important step towards improving the natural environment on a wide scale. Similar opportunities to enhance ecological networks are being taken by local authorities and communities through the planning and delivery of Green and Blue Infrastructure, where land and water is spatially connected to improve the lives of wildlife and people. These can often be low cost but highly effective solutions but do require forward planning and good engagement with land owners and communities.

Existing legislative limit

Local limits are, in effect, set through BAP targets and identifying protected sites following an assessment and/or modelling.[25]

EU and UK legislation requires any plan, project or permission that may have an impact upon protected sites to undergo a Strategic Environmental Assessment on the impacts to propose mitigation options where potential negative effects are identified, and enter consultation with relevant authorities and the public.[26]

2.3 Climate change

Climate change is not just an international issue. It poses problems for communities and local areas too, as specific areas will become more susceptible to impacts such as flooding, water shortages and other health and wellbeing risks.

As well as taking action to ensure we are on a clear trajectory towards safe atmospheric concentration limits, we need to measure and set limits on the levels of carbon lost from stores in soils, vegetation and the marine ecosystem. The capacity of particular places and environments to sequester carbon is as important as reducing our emissions, and is an approach that will often need to be managed locally.

Pressure

The Intergovernmental Panel on Climate Change conclude that warming of the global climate system is unequivocal and that many natural systems are being affected by regional climate changes. Most of the global average warming over the past 50 years is 'very likely' due to anthropogenic greenhouse gas (GHG) increases.[27]

Over 40 per cent of current CO_2 emissions are caused by the choices we make as individuals.[28] Coming together as groups of individuals we have a significant opportunity to amend this. We put pressure on our climate, and therefore the natural environment, through producing greenhouse gas emissions on a number of scales:

- From a personal, household and business perspective, including the carbon footprints of our habitual lifestyles
- From our local area's activities, including building, agricultural and industrial emissions, and missing sequestration and adaptation opportunities (e.g. green space and infrastructure)
- From a local to a national and international scale, as cumulative local activity contributes to our proximity to national limits.

State

The UK has experienced nine of its 10 warmest years on record since 1990.[29, 30] The UK Climate Impacts Programme (UKCIP) provides potential impact scenarios nationally and regionally. It predicts that in the 2080s summer average temperatures will increase between 3 and 4°C across the UK, with regional variations including up to 5.4°C rises in southern England. Annual precipitation levels in the 2080s will also vary regionally. The greatest changes in winter will be along the west of the UK, with increases up to +33 per cent, whereas in the Scottish highlands decreases are expected. In summer the greatest changes are in the far south of England, down to about –40 per cent.[31] Such future impacts and variations could lead to increased flooding, heat waves and drought; reduced biodiversity and agricultural productivity; changes in the character and identity of our local places, and more.

Response

The principle of environmental limits has been powerfully established in law and policy for atmospheric concentrations of greenhouse gases in the form of the Climate Change Act, carbon budgets, the 10:10 commitment and more. Together, these mechanisms make the issue, consequences and proposals for action tangible at all scales. They also create a framework for limits to be recognised, updated and adhered to beyond the life cycle of governments. This 'response' also sets a series of safe future 'states', against which the current state can be measured effectively. When we are confident that our response is based on sound, robust scientific evidence and is monitored effectively, this approach provides an effective way to ensure we are living within environmental limits.

Progress against the UK Climate Change Act illustrates the success of this response, and our ability to adapt the response according to observational feedback. The Act sets a target to reduce greenhouse gas emissions to at least 80 per cent below the 1990 baseline level by 2050. Within the Act, 'carbon budgets' place legally binding ceilings on emission levels over five year periods.[32] In 2009, UK emissions fell by 8.6 per cent, a significant improvement on the

1.9 per cent decrease of 2008. However, the Committee on Climate Change concluded that this improved performance was largely due to the recession and other 'exogenous factors',[33] and that although progress towards the interim 2020 target was made easier, a 'step change' in underlying progress is still required if carbon budgets are to be achieved.[34]

Although these limits have been set and mitigation steps are being taken, it is also a priority to adapt to climate changes that we will already have caused by breaching limits. An example of the costs of not doing so was raised by the authorities in Manchester City Region and the North West undertaking their own 'mini-Stern' report. The report estimated that the city region risks losing £12 billion over the next twelve years if it fails to adapt to climate change (£70 billion for the North West region).[35]

Existing legislative limit

The Kyoto Protocol requires that greenhouse gas emissions are reduced by 12.5 per cent below the base year (1990) levels over the 2008-12 period. The UK Climate Change Act requires that greenhouse gas emissions are reduced by at least 80 per cent below the 1990 base year levels by 2050.

The first three UK Carbon Budgets under the Act run from 2008-12, 2013-17 and 2018-22, and require a reduction in greenhouse gas emissions by at least 34 per cent by 2020, relative to 1990 levels. The fourth carbon budget, covering 2023-2027, must be set by 30 June 2011.

2.4 Noise and light

Peace and quiet and the natural light cycles of day and night are important for the mental and physical health and wellbeing of humans and other animals.

Noise pollution is unwanted sound that disrupts wellbeing. Light pollution is the alteration of natural light levels in the outdoor environment due to artificial lighting, such as the light emitted from buildings, streetlights, security lights and illuminated sporting venues.

Pressure

Both noise and light pollution are usually the result of human activity and are much higher in urban areas, close to transport networks and to industry. The main sources of noise pollution are road, rail and air traffic, construction and industrial processes.

It can cause both physical and psychological damage in humans, including sleep disturbances, hearing loss, tinnitus, frustration and aggression, high stress levels, and hypertension. Noise can also have a negative impact on wildlife by affecting its ability to detect prey and avoid predators, by causing stress, and interfering with their communication and therefore affecting reproduction and navigation.

Overexposure to light or unwanted light shining directly into a property can affect human health by causing stress and disturbing sleep. The wide-scale illumination of the sky above an urban area is known as 'skyglow' and is caused by dust and pollution suspended in the air which scatters light in all directions. Skyglow can obscure the stars in the night sky and disrupt ecosystems by disturbing the natural cycles of species. Alterations to natural light levels can also affect an animal's ability to navigate, the relationship between predator and prey, and competitive interactions.

State

The European Commission's 1996 Green Paper estimated that 20% of EU citizens were exposed to noise levels that scientists and health experts considered to be unacceptable.[36] A study carried out in 2001 on light pollution showed

that 99% of the population of Europe live in areas where the night sky is above the threshold set for polluted status and more than one half do not have naked eye visibility of the Milky Way.[37] The Campaign to Protect Rural England has mapped both tranquillity and light pollution in the UK and states that between 1993 and 2000 the amount of truly dark night sky fell from 15% to 11%.[38]

Response

The European Environmental Noise Directive requires Member States to draw up strategic noise maps and action plans to deal with excessive noise, which can be viewed on Defra's website.[39] It is not possible to establish a single limit for noise, as its impact depends on the source, the receptor and the time.[40] However, there are various local and night restrictions on noise, for example the Noise Act (1996) in England sets permitted night noise levels and provides powers to local authorities to inspect their areas, investigate complaints and serve abatement notices.[41] With regards to light, the Clean Neighbourhoods and Environment Act (2005) extended the statutory nuisance regime to include artificial light. Local authorities have a duty to investigate complaints of light nuisance and serve abatement notices when applicable. There is no objective measurement to determine when artificial light becomes a 'nuisance' and the law only applies to light that is interfering with a person's property or health; it does not apply to skyglow.

Existing legislative limit

There are various local and night restrictions on neighbourhood and environmental noise, for example, night noise is not to exceed an underlying level of 24 decibels.[42]

2.5 Water

Water is essential for supporting all life. We humans use water for drinking, washing, producing food, industrial processes and maintaining our general quality of life. The quantity, quality, distribution and ecological status of water resources are all vital, and our use of water as a resource should not damage our natural environment.

Pressure

We put pressure on water resources through:

- **Water demand** – we take water out of lakes, rivers and groundwater supplies for use in our homes, workplaces and in the production of food, goods and services. As our population grows and our climate changes, the pressure on water resources will increase. One third of England and Wales' river catchments are over-abstracted or over-licensed, risking significant damage to ecosystems. Even though actual abstraction is 50-60 per cent of the licensed amount, it already results in between 1,100 and 3,300 million litres more being taken per day than the environment can sustain[43,44,45]
- **Water pollution** – the biggest pressure on water quality is treated sewage effluent from homes, offices and industry. Diffuse pollution also affects the ecological status of water resources. In urban areas the pollution tends to be from roads and sewer overflows, and in rural areas it tends to be from agricultural run-off. Some pollutants are easily transmitted via water, being picked up by rainwater in the air and washing over concrete or through soil, so it can be difficult to pinpoint the actual source of the pollution
- **Land use** – when we build on a piece on land, we often take away its ability to absorb water and prevent flooding. Changes in the way land is farmed can also have profound effects on its ability to store water, regulate and balance river flows, and strip out pollutants.

State

- **Water availability** – our water supply is limited and varies by region due to natural rainfall patterns, underlying geology and our capacity to store water in reservoirs. Its availability is then dependent on the population density, level of demand and by season. In recent years England and Wales have experienced major droughts from 1990-92, 1995-97 and 2004-06.[46] Parts of the South East of England have less water per person than Sudan and Syria[47]
- **Water quality** – although the quality of our rivers, lakes and groundwater has improved over recent decades, diffuse water pollution remains an issue. The Environment Agency reports that only 26% of rivers, 36% of lakes and reservoirs and 27% of estuaries and coasts in England and Wales have achieved 'good' or 'better' ecological status[48]
- **Flooding** – the trend towards increasing the hard standing of our surfaces in the UK through development, combined with building on floodplains and coastal areas, increases the flood risk. The Environment Agency estimates that around 5.2 million, or one in six, properties in England, are at risk of flooding and that this risk is going to increase in the future due to climate change and development pressures.[49] The 2007 summer floods cost the country a total of £3.2bn.[50, 51, 52] Claims for storm and flood damages in the UK doubled to over £6 billion over the period 1998 – 2003, with the prospect of a further tripling by 2050.[53]

Response

The European Water Framework Directive commits all Member States to achieve 'good' ecological and chemical status of all water bodies by 2015.[54] It does not set limit values but defines criteria for identifying the status of water bodies. It also requires the development of River Basin Management Plans, which cover the protection, improvement and sustainable use of the water environment. The Environment Agency is responsible for preparing the River Basin Management Plans, managing water quality, abstraction and flood risk in England and Wales.[55]

Existing legislative limit

EU requirement to achieve 'good' ecological and chemical status of all water bodies by 2015[56]

2.6 Soils

The quality and quantity of our soils is often overlooked but they are a critical foundation for our development. They are the foundation of our landscapes and associated leisure activities and cultural identity, and they enable us to produce food, fibre and other raw materials. Perhaps less obviously, soils act as a valuable habitat and regulator of life. They host a wealth of organisms which together provide the life-supporting benefits of rich biodiversity, and they store and regulate water and air. By storing around twice the amount of carbon that is stored in the atmosphere and three times the amount in vegetation,[57] soils also enable us to be better protected from the effects of climate change.

Pressure

The following activities degrade soils and therefore reduce the productivity of land and the benefits of biodiversity; pollute our waterways; and increase the potential and intensity of flooding:

- Building on land 'seals' the soil surface and compacts the soil - this reduces the benefits of carbon sequestration and furthermore makes areas vulnerable to the effects of climate change by increasing urban heat island effects and decreasing water infiltration rates.[58] Much of the flooding in England in the summer of 2007 was due to surface water[59]
- Certain types of intensive agriculture and other human activities erode the soil surface both directly (mechanically), and indirectly as hardened, compacted surfaces suffer from increased surface water flow
- Chemical inputs (e.g. fertiliser) harm the soil, the biota within, and the water system as chemicals enter groundwater flows and run off the surface.

State

Contamination and poor soil management are causing problems across the UK.[60] Changing agricultural practices and the scale at which development is occurring has resulted in the removal of many small scale natural features, such as hedgerows, resulting in a steady loss of soil overall, and damage and erosion to remaining stocks. Soil quality is also being reduced, again through agricultural practices but also due to inappropriately sited development. Peat bogs, valuable for storing high levels of carbon as well as providing a habitat for important species, are under threat from drainage, burning, overgrazing and industrial pollution. This degradation of peat bogs means we are losing carbon at a rate equivalent to the emissions from over a third of a million homes.[61]

The quality of the soil is often a key determinant of the price put on a piece of land but it is often 'poorer' quality or lower priced land that has the greatest ecological and social benefits, for example brownfield sites or flood plains. Ironically, their perceived lower value promotes their development for housing and renewable energy, thereby destroying their natural function and eventually leading to far greater economic costs.

Response

Cross Compliance and Environmental Stewardship schemes provide regulation and funding for farmers and landowners to manage soils - and land generally - for environmental benefit, along with locally-tailored advice through schemes such as the Catchment Sensitive Farming Delivery Initiative.[62] Debate is ongoing over the EU Common Agricultural Policy and its application in the UK, however as mentioned in the introduction to Section 2 the SDC considers soil management an issue on which little or no action has been taken to recognise and apply regulation or legislation to environmental limits. We consider that awareness of the importance of this issue is low, but that it is a crucial area for action, particularly given its implicit connection to the other issues featured in this guide.

The SDC recommends that central government recognises soil management as key to conserving the natural environment, and goes further in setting environmental limits on levels of mechanical management, chemical inputs, and soil sealing.

2.7 Land use

The Foresight Land Use Futures[63] report notes that "the ability of given parcels of land or landscapes to deliver multiple benefits simultaneously – so called 'multifunctionality' – adds to its value and versatility."

Pressure

We place many competing pressures on land, including food production, housing and infrastructure, green space and recreation, space for biodiversity, carbon sequestration, economic development, cultural identity, transportation, mineral extraction and waste management/disposal and maintenance of open landscapes. Land in the UK is scarce and the role of our spatial land use planning system is to balance these competing demands for space. But pressure for economic development and changes in demographics and consumption patterns can often mean that non-development land uses such as space for ecosystems and ecological networks, and the maintenance of open landscapes, are often deprioritised. This can also result in less space for landscapes of important cultural identity and the conversion of land from ecologically reversible use (such as organic farming) to relatively irreversible use (such as urban development). The SDC believes that the concepts of resilience and reversibility of use will become increasingly important and should be key principles for land use planning.

State

We have a finite land resource but over time the quantity is not static. Natural processes have always changed the amount of land that is available, particularly around coastal areas, but the impacts of climate change could see these rates of change increase and at a level that will require us to adapt our current development practices as societal priorities. For example, building on urban extension areas may have to be restricted if these areas also function as natural flood plains, as this function will give them greater economic value. Combining this reduction in land availability with the ever-increasing demand for development is also leading to the fragmentation of ecologically functioning areas of land, and an increasing blurring of the line between urban and rural. This can have significant impacts on biodiversity as individual habitats become too small to support particular species and the physical gaps between the habitats are too large for species to move between safely. Such fragmentation also undermines landscape quality and openness, two characteristics that have considerable social and cultural value.

A number of organisations, such as Natural England and the RSPB, have produced significant work on 'landscape-scale conservation', focusing on the need to safeguard ecosystems and ecological networks. Such work aims to protect and enhance the essential services these systems provide and also help build their resilience to future climate change impacts.

Response

In theory, the planning system provides the best means of assessing the multiple benefits of land and allocating uses accordingly. However, it should be noted that a large proportion of UK land falls outside the planning system as it is allocated for agriculture. As noted in the 'Soils' subsection above, the EU Common Agricultural Policy and its application in the UK elicits continuing debate. Cross Compliance, Environmental Stewardship schemes and other locally-tailored management schemes currently provide regulation and funding for farmers and landowners to manage land for environmental benefit. However, these funds would achieve greater benefits for biodiversity and the public purse if used to encourage and support the connectivity of managed land and habitats across a wider area, rather than on smaller, individual plots of land.

As mentioned in the introduction to Section 2, the SDC considers land use an issue on which little or no action has been taken to recognise and apply regulation or legislation to environmental limits – in terms of management and in terms of change. We consider that awareness of the importance of these issues is low, but that they are crucial areas for action, particularly given their implicit connection to

the other issues featured in this guide. The purpose of planning is sustainable development, and the planning system has a particularly critical impact on our ability to live within environmental limits, now and into the future. A genuinely sustainable planning system is one that should promote the highest quality development and most efficient and effective use of land, in the most appropriate locations at the most appropriate time, and which delivers results that are in the public interest. The management of agricultural land should also be given important local-level consideration alongside the planning system.

The SDC recommends that central government identify acceptable levels of land use change which will reduce fragmentation and maintain and enhance the multifunctionality of land.

3. Local responses - Living within environmental limits

Every individual, household, business, community and public sector body impacts on the natural environment, in ways which may be negative or positive. But it is often difficult to see and feel the consequences of these impacts and it can therefore be challenging to live within environmental limits. Much of the discussion on environmental issues is carried out at the national and international scales, which can also reduce the sense of responsibility and importance of tackling these issues at a local level. But setting environmental limits locally, understanding how they interact and what they mean for our communities can help us limit the pressure that we put on the natural environment and maintain quality of life for both current and future generations.

Sections 1 and 2 set out the reasons we need to live within environmental limits, and the scale of the challenge we face, which may seem an impossible task or at best an uphill struggle. Central government has a critical role to play. The SDC has advised Government on its role, the urgent need to embed the concept of environmental limits into its policy development and to provide support to empower local areas. [64,65] This will help but, in the meantime, there is already an opportunity for communities and local bodies to take a lead in moving us all towards a sustainable future. Section 3 provides some suggestions for this action at the local level. Many of these suggestions are already underway in one form or another in some areas of the UK, or draw on existing ideas, research and structures. Action will not always require new resources or reinventing the wheel. The requirement now is to ensure this good practice is replicated across the country and that environmental issues and limits are considered together and as a whole (see Diagram 2). Partnership working is key and will help to make available many of the tools, guidance and assistance already out there.

This section focuses on two levels of local action: community groups and local governance (including local authorities, public service providers and local partnerships such as Local Enterprise Partnerships). Through these two groupings, local individuals, households, businesses, charities, government agencies and central government can all be accessed and worked alongside. Community groups and local bodies directly interact with all of these groupings and therefore benefit from a wide range of influence, as well as the ability to use participative systems of governance that engage people's creativity and energy. All of the groups above play an important role in protecting the local environment, and provide various levels of understanding of local distinctiveness and the diverse needs of local people. Their role in delivering services and change is also becoming more significant as the Government's localism plans come to the fore.

All communities will benefit from successfully living within environmental limits, through:

- improved living conditions
- tackling 'upstream' causes and preventing problems arising, therefore reducing pressure and spend on public services
- resource- and cost savings gained out of a sustainable development approach and environmental efficiency
- building resilience by making communities less dependent on unsustainable resources, and more adaptable to climate change
- profit from successful business models in this area.

Living within environmental limits has to start at local level if it is to work at all. The following subsections provide information on why and how the two primary groups can take action to make this happen, followed by a selection of more specific examples of action each group could take, in Table 1.

3.1 Community Groups

Every individual and community benefits from the natural environment as well as puts pressure upon it, often without being fully aware of the consequences. Individual action to reduce our impact on the environment is essential, but can feel ineffective in the grand scale of the environmental challenge we face. But collections of individuals have the potential to recognise and raise awareness of environmental limits, to take collective action, to create a louder voice, to pool resources and obtain funding, and to develop partnerships with other organisations.

Community groups can and do take on a number of forms and structures. Here, we simply mean a collection of locally-based people that have come together to act in their shared self-interest. The group may operate in one (or more) of a number of formal structures or statuses, including charitable, voluntary, social enterprises, political pressure groups or service providers.

Twenty years on from the Rio Earth Summit and Local Agenda 21, there is wide-scale grassroots community-based action on the environment and sustainable development – the Transition Towns movement and the Greening Campaigns being just two examples. Many others are working on a variety of scales and budgets towards achieving large-scale ambitions such as combating climate change through reducing building stock emissions, to campaigning for very locally-driven priorities such as improvements to a local park or safer neighbourhoods. The SDC's *The Future is Local: Empowering communities to improve their neighbourhoods*[66] provides a series of case studies of existing community action and success, and guidance on how groups can efficiently address multiple local priorities, access finance and work in partnership with authorities and businesses to achieve more. The following list provides some examples of the types of action community groups can pursue. This is not an exhaustive list, and unique local circumstances and ingenuity will create further options.

What can community groups do?

- **put pressure on** local authorities and central Government to define environmental limits – both locally and nationally - and to make decisions and to regulate with these limits in mind
- **use knowledge of the local area** and work with local authorities to set limits, and monitor the state of the environment and progress towards keeping to the limits
- **monitor** published information on local environmental quality, such as air quality, and **campaign** for improvements, holding public bodies to account
- **work with local authorities to improve local plans and strategies' coverage of key environmental limits**, for example the Community Strategy[67] and Local Development Framework[68]
- **work with local authorities, businesses and other relevant groups to help deliver public services** in a way that utilises the multiple benefits of the natural environment, for example for health and wellbeing, at the same time as limiting the pressures put on it[69]
- **monitor planning applications** for developments; respond to planning consultations; and vote in community Right to Build referendums[70]
- **pool resources and expertise** to run neighbourhood/community-wide projects and installations which will reduce negative local environmental impacts e.g. retrofitting buildings for energy and resource efficiency, or installing renewable energy technologies. Many such projects will benefit from addressing multiple objectives and working in partnership with other local groups and authorities[71]
- **establish and manage** communal green space and protected areas[72]
- **encourage behaviour change** within the community that reduces pressure on the environment, such as lift sharing, tree planting, conserving energy and water, and switching off outdoor lights.

3.2 Local governance

Local governance refers to a range of structures and organisations that serve a locality, including:

- Parish and local authority councils
- Local governance partnerships, for example Local Enterprise Partnerships, Multi Area Agreements
- Other public service providers, for example Housing Associations, Passenger Transport Authorities.

Local governance provides a number of functions that are important on a local, regional and national scale, including economic development, public health improvement, policing and emergency services, and social care. The way our public services are governed at a local level has a direct impact and influence on the choices and behaviour of communities, individuals and businesses. It is also of great economic importance, with local partners spending over £200bn per year[73] on local services, which may have positive or negative environmental impacts.

Local governance bodies often hold expertise and resources for protecting the natural environment, and already follow a number of processes on air quality management, Environmental Impact Assessments, Local Biodiversity Action Plans (BAPs), River Basin Management Plans, and more. Often, to achieve the ultimate aim of living within environmental limits and reaping the benefits this will bring, all that may be required is a re-think of the application of these resources, recognising how different aspects of the environment interact (see Diagram 2), and drawing on wider partnerships with the community and local businesses. Significant long-term benefits and cost savings can be delivered in this way,[74] with little need for extra effort or resources. The planning system can also provide financial resources for environmental enhancement through the appropriate use of processes such as Section 106 and the Community Infrastructure Levy.

The following list provides some examples of the types of action local governance bodies can pursue. As with the suggestions for community groups this is not an exhaustive list, and it will be bolstered by ideas and action relevant to unique local circumstances.

What can local governance bodies do?

- **set ambitious local environmental limits** which will enable current and future generations within the local area to live healthily and equitably. The limits should be set in discussion with, and with support from, local people and community groups. Central government should also be called upon in order to utilise the latest monitoring data available and to ensure a consistent, nationwide spatial approach
- develop, in partnership with the local community, a **long-term vision** for protecting and enhancing the natural environment that recognises the value the environment provides in supporting all public services. This vision should be based on the environmental limits set for the local area, as above. It should then be incorporated into all other plans and strategies, for example for economic regeneration, housing, transport, and spatial planning
- **take stock and monitor** the status of local environmental assets and progress towards the long-term vision. For example, maintain up-to-date records on BAPs, green space availability and quality, air quality levels and cultural assets, and compare to the local environmental limits – this may include existing target levels and proxy limits. **Report and communicate** details and progress against the limits to communities for transparency and dialogue, and to central government as mediator
- **raise awareness** of environmental limits and **provide advice** to the wider community on how to reduce pressure on the environment
- **lead by example** in the way that you run your buildings and manage your land
- **work in partnership** with local communities, businesses, regulators and central Government on projects to enhance and protect the environment. This approach can save money, increase transparency and

improve wellbeing of the local community. For examples and evidence of the benefits, see *The Future is Local: Empowering communities to improve their neighbourhoods*[75]

- **facilitate and promote** community-led projects
- **provide services** in a way that protects the natural environment and improves the health and wellbeing of the community as well as driving cost efficiencies. For example, providing and improving public transport, cycle paths, green gyms and domestic energy efficiency schemes[76]
- **pool budgets** and work with other service providers to achieve multiple benefits from investing in environmental protection. For example, achieving a more joined-up approach to public health delivery by improving access to green space, promoting active travel, reducing traffic, improving household conditions and installing climate change mitigation measures can result in a reduced health care bill and an enhanced natural environment
- **attract private sector investment** in the natural environment by articulating the financial benefits of a cleaner, greener and better functioning environment, as well as the financial return from investing in renewable technologies. **Lobby central government** to assist with de-risking small-scale projects for private investment by underwriting or aggregating such projects, and developing new models and mechanisms for community investment support
- **use Section 106 agreements** (Town and Country Planning Act, 1990) to make environmental improvements to a planning proposal or offset the environmental impact of a development
- consider using **conservation credit schemes** that allow developers to offset the environmental damage of their developments. This may only prove worthwhile if the benefit is felt within your locality
- **investigate using Social Impact Bonds** to drive non-government investment into preventative services,[77] such as encouraging cycling to reduce obesity or increasing green space and gardens in hospital grounds to assist patient recovery
- **consider the role of environmental evaluation** and how it could be used to highlight the costs and benefits of different policy options and action to live within environmental limits. Request guidelines and advice from central government on how this tool may be utilised effectively and fairly.

3.3 Examples of action that can be taken

Table 1, below, outlines some suggestions for specific action alongside simple changes in behaviour and increased resource efficiency – that can be taken by community groups and local governance bodies to reduce the pressure on each of the environmental categories covered in Section 2. These and other such actions can be undertaken separately, but together can improve environmental conditions as a whole by underpinning the overarching actions suggested in Sections 3.1 and 3.2.

Table 1: Examples of action to be taken by community groups and local governance bodies

	Community Groups	Local Governance Bodies
Air quality	• Reduce car use e.g. lift sharing/pooling,[78] walking and cycling, promoting or campaigning for improved public transport • Monitor published data on air quality (held by local authorities) and lobby/assist local authorities to ensure compliance with regulations.	• Carry out local air quality management (LAQM) duties • Improve provision and accessibility of non-motorised and public transport • Spatial planning to reduce the need to travel.
Biodiversity and habitat quality, quantity and connectivity	• Support local wildlife trusts[79] • Provide habitats e.g. bat and bird boxes, hives, ponds, etc. • Monitor central government/local authority proposals for public land use change. E.g. consultation on the future of the public forest estate[80] and the local designation of important community areas[81]	• Provide, enhance and connect green space and protected areas • Manage own land and estates to support biodiversity • Facilitate/promote local conservation projects through community groups and schools.
Climate change	• Reduce energy consumption and improve energy efficiency, personally and in community buildings[82] • Install renewable energy technologies in your homes or community[83] • Establish/lobby for green space and infrastructure.	• Improve provision and accessibility of non-motorised and public transport and green infrastructure • Provide and support community energy efficiency and generation schemes[84] • Assess adaptation options and undertake a 'Mini-Stern'[85] style report.
Noise and light	• Report excessive noise or light to local environmental health officers • Lobby local authority to review public lighting • Reduce outdoor lighting, using downward lighting only.	• Manage own operations to produce minimal noise and light • Encourage Government to carry out further research into 'significant observed adverse effects' of noise to establish a range of limits[86] • Investigate the possibility of adopting the Institution of Lighting Professionals' guidance on the reduction of obtrusive light.[87]
Water	• Reduce water consumption and increase efficiency, personally and in community buildings e.g. retrofit buildings & install greywater technologies • Engage with the water company on their water resources management plan • Engage with local authorities on their River Basin Management Plan(s) and community flood action plans.[88]	• Work with water companies and regulators to reduce abstraction or to relocate to appropriate areas, and reduce leakages[89] • Ensure spatial planning decisions reflect water availability and flood risk • Install green infrastructure and sustainable urban drainage systems (SUDS) where appropriate
Soils	• Reduce use of chemicals in gardens and community areas • Create and use compost where practicable – including community allotments. Where collection schemes are not available, lobby your local authority for provision • Protect garden soil by maintaining hedges and reducing paved areas.	• Improve vegetation cover and protection of green space • Advise/assist industries with limiting erosion, run off and chemical inputs etc. • Provide and improve green infrastructure to improve soil structure, absorb carbon and increase infiltration rates, alongside wider benefits.

Land use	• Request land for production of local food crops e.g. allotments • Respond to planning consultations and vote in Community Right to Build referendums[90] • Monitor central government/local authority proposals for public land use change. E.g. consultation on the future of the public forest estate[91] • Seek advice and support from local wildlife trusts.[92]	• Allocate public owned land to achieve a range of different functions • Ensure spatial planning supports the multifunctionality of land • Use the local designation of important community areas to protect sites.[93]

4. Conclusion

The natural environment provides for us our essential elements for life, along with a host of resources and services which enable us to enjoy and value our lives all the more. Living within environmental limits will enable us to preserve the range of benefits we draw from our environment, and enhance our own quality of life. Recognising where these limits are – even if at first through proxy levels based on our best judgement or available information – can and should be started at the local level, where we best know our surroundings and can benefit directly from improvements to the area and associated cost savings.

This guide has set out seven environmental issues which the SDC sees as key areas for improving our local environment, and for which environmental limits should be set. This is not an exhaustive list, but should provide readers the information needed to start asking, and answering, the necessary questions. Through the 'pressure-state-response' model our aim has been to highlight the relevance and importance of these issues in turn, but also to stress the fact that responses to improve their state should be taken collectively. The natural environment is a complex system with many interacting and mutually supportive components. Living within environmental limits means appreciating this fact and working together as experts and enthusiasts, for the benefit of the environment and for all of us reliant upon it.

Local governance bodies and community groups have an essential role to play here, as together they share the tools, ability and knowledge of the local area necessary to take on the task. For that reason they are the intended audience for this guide. We hope that the information and suggestions for action provided here will have some resonance across the many members these audiences span, and will act as the basis for further work and research. But there is still a vital role to be played by central government, through supporting and providing the means and tools necessary to support local groups in their actions. The SDC will communicate this intention to government, but this communication should continue through discussion, lobbying and feedback across all three audiences.

Of all of the environmental issues presented here, the SDC considers that little or no action has been taken to recognise and communicate environmental limits on the issues of soils and land use. Subsections 2.6 and 2.7 provide information on why these are vitally important issues, along with the following recommendations to government:

The SDC recommends that central government recognises soil management as key to conserving the natural environment, and goes further in setting environmental limits on levels of mechanical management, chemical inputs, and soil sealing.

SDC recommends that central government identify acceptable levels of land use change which will reduce fragmentation and maintain and enhance the multifunctionality of land.

Once regulatory, legislative and educative action is taken and promoted to recognise and live within environmental limits, collectively and across all seven environmental issues presented here - in the way that it has been for issues such as air quality and climate change - we can all reap the multiple rewards of our actions. We hope that this guide provides a strong footing to help move on in that direction.

5. Annex: Where to get further information

Government departments and agencies

Department for Energy and Climate Change (DECC) – www.decc.gov.uk
For UK legislation, strategies and information on:

- Climate change and the international and national strategy for tackling it
- The UK's energy supply
- Advice to households and communities on how to reduce greenhouse gas emissions and generate renewable energy
- Opportunities to move towards a low carbon economy.

Department for the Environment, Food and Rural Affairs (Defra) – www.defra.gov.uk
For UK legislation, strategies and information on:

- The natural environment, biodiversity, plants and animals
- Sustainable development and the green economy
- Food, farming and fisheries
- Animal health and welfare
- Environmental protection and pollution control
- Rural communities and issues.

Environment Agency – www.environment-agency.gov.uk
For information on:

- Regulation of major industry
- Flood and coastal risk management
- Waste management
- Agriculture
- Navigation
- Fisheries
- Contaminated land
- Conservation and ecology
- Water quality and resources
- Climate change.

Natural England – www.naturalengland.org.uk
For information on:

- Conservation
- Farming and land stewardship
- Enjoying the natural environment.

Some examples of Non-Government Organisations

BioRegional – www.bioregional.co.uk
BioRegional is an entrepreneurial charity which initiates and delivers practical solutions that help us to live within a fair share of the earth's resources – what they call one planet living.

British Trust for Conservation Volunteers (BTCV) - www.btcv.org.uk
The charity was set up in 1959, and has a successful history of environmental conservation volunteering throughout the UK and around the world.

Friends of the Earth (FOE) - www.foe.org.uk
FOE campaigns for solutions to environmental problems.

Global Action Plan (GAP) - www.globalactionplan.org.uk

GAP focuses on people and how they can take practical action in their everyday lives for a better world. They work across different areas of sustainability including food, energy, water, and waste.

Groundwork - www.groundwork.org.uk
Groundwork is a group of charities helping people and organisations make changes in order to create better neighbourhoods, to build skills and job prospects, and to live and work in a greener way.

Local Government Information Unit (LGiU) – www.lgiu.org.uk
LGIU provides practical policy advice, learning and development programmes, events and conferences, consultancy and other resources covering:

- Natural environment and resources
- Climate change adaptation
- Flooding.

Royal Town Planning Institute (RTPI) – www.rtpi.org.uk
For information about spatial, sustainable, integrative and inclusive planning.

Transition Network -
www.transitionnetwork.org
Transition Network's role is to inspire, encourage, connect, support and train communities as they self-organise around the transition model, creating initiatives that rebuild resilience and reduce CO_2 emissions.

The Wildlife Trusts – www.wildlifetrusts.org
There are 47 local Wildlife Trusts across the UK dedicated to conserving a range of the UK's habitats and species, whether they be in the countryside, in cities or at sea. They carry out practical work and community engagement to protect and enhance the natural environment. Various publications are available on their website.

WWF - www.wwf.org.uk
Conservation body with a passion for safeguarding the natural world through tackling the global threat of climate change and helping people to change the way they live to ease pressure on natural resources.

6. References

[1] For a more detailed account of 'ecosystem services', see http://www.ecosystemservices.org.uk/ecoserv.htm or the reports of the Millennium Ecosystem Assessment, which proposed the original classification, at http://www.maweb.org/en/Index.aspx

[2] The Office for National Statistics reports that the population density for England in 2009 was an average of 398 people per km^2, which was the third highest in Europe after Malta (1281) and the Netherlands (485). See ONS, 2010. *The UK Population: How does it compare?* Available at http://www.statistics.gov.uk/articles/population_trends/03-poptrends142ns.pdf

[3] OECD, 1993. *OECD Core Set of Indicators for Environmental Performance Reviews: A synthesis report by the Group on the State of the Environment*.

[4] Ibid

[5] For more information on the Precautionary Principle, see http://www.jncc.gov.uk/default.aspx?page=2519

[6] For more information on 'ecological footprints', see, for example http://wwf.panda.org/about_our_earth/teacher_resources/webfieldtrips/ecological_balance/eco_footprint/

[7] For information on The Economics of Ecosystems and Biodiversity research see http://teebweb.org

[8] For information on the UK National Ecosystem Assessment see http://uknea.unep-wcmc.org

[9] Defra, 2010. *Air Pollution : Action in a Changing Climate.* *http://www.defra.gov.uk/environment/quality/air/airquality/strategy/documents/air-pollution.PDF*

[10] Defra, 2010. *Air Pollution in the UK 2009 – Edition A.* Available at http://www.airquality.co.uk/annualreport/annualreport2009.php?d=es#mid

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[12] See the Air Quality Standards Regulations 2010 at http://www.legislation.gov.uk/uksi/2010/1001/contents/made

[13] For further information see http://ec.europa.eu/environment/air/quality/standards.htm

[14] For further information see http://www.defra.gov.uk/environment/quality/air/airquality/local/index.htm

[15] See http://ec.europa.eu/environment/air/quality/standards.htm

[16] FAO, 2009. The State of Food Insecurity in the World. Economic Crises – Impacts and Lessons Learnt. Food and Agriculture Organization of the United Nations, Rome.

[17] Food, Energy, Water and the Climate: A Perfect Storm of Global Events? A 2009 paper by John Beddington, Chief Scientific Adviser to HM Government, available at http://www.bis.gov.uk/go-science/news/speeches/the-perfect-storm

[18] http://www.wwf.org.uk/what_we_do/about_us/living_planet_report_2010/

[19] Defra, 2011. Statistical Release: Indicators of Biodiversity in England - http://www.defra.gov.uk/evidence/statistics/environment/biodiversity/pdf/110120-stats-bio-indicators.pdf

[20] Bird populations are considered to be a good indicator of the broad state of wildlife because birds occupy a wide range of habitats, they tend to be near or at the top of food chains and there are considerable long-term data on changes in bird populations which helps in the interpretation of shorter term fluctuations.

[21] UK figures 49 per cent and 24 per cent lower respectively. Figures from Defra, RSPB and BTO (2011) – see http://www.defra.gov.uk/evidence/statistics/environment/wildlife/kf/wdkf03.htm

[22] For a background on BAPs, see http://www.ukbap-reporting.org.uk/plans/whatbap.asp

[23] JNCC, 2010. Main Results of the 2008 UK Biodiversity Action Plan Reporting Round, Published by JNCC on behalf of the UK Biodiversity Partnership – available for download here - http://www.jncc.gov.uk/default.aspx?page=5398

[24] Lawton, J.H. et al, 2010. Making Space for Nature: a review of England's wildlife sites and ecological network.

[25] For example, Special Areas of Conservation (SACs), Special Protection Areas (SPAs), Ramsar sites, Sites of Special Scientific Interest (SSSIs), National Nature Reserves and Marine Nature Reserves

[26] For more information, see ODPM, 2005. A Practical Guide to the Strategic Environmental Assessment Directive - http://www.communities.gov.uk/documents/planningandbuilding/pdf/practicalguidesea.pdf

[27] IPCC, 2007. Climate Change 2007: Synthesis Report.

[28] Met Office/Act on CO_2, 2009. Warming: Climate Change – the facts

[29] Jenkins, G. J., Murphy, J. M., Sexton, D. M. H., Lowe, J. A., Jones, P. and Kilsby, C. G., 2009. UK Climate Projections: Briefing report. Met Office Hadley Centre, Exeter, UK. Version 2, December 2010. For more information, see http://www.ukcip.org.uk/

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[32] For further information on carbon budgets in the UK Climate Change Act, see http://www.theccc.org.uk/carbon-budgets
[33] Committee on Climate Change, 2010. Meeting Carbon Budgets – ensuring a low-carbon recovery: 2nd Progress Report to Parliament
[34] Ibid.
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[38] For further information see http://www.cpre.org.uk/campaigns/landscape
[39] The maps can be viewed on Defra's website at www.defra.gov.uk/noisemapping.
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[41] For further information see http://www.defra.gov.uk/environment/quality/noise/guidance/documents/noise-act-guidance.pdf
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