Environment Kernow

ENVIROLIMITS

Determining the environmental limitations to the growth of Cornwall and the Isles of Scilly

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Author – Alex Ledbrooke
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Executive summary

The Enviro-limits project has three key aims;

- Produce an evidence base for key environmental data in Cornwall & the Isles of Scilly and, identify gaps in the evidence.
- Provide details of principal environmental factors that limit population and economic growth, such as food, energy and water.
- Establish the preparedness of Cornwall & the Isles of Scilly for a sustainable future.

For the economy and population of Cornwall and the Isles of Scilly to develop and grow there must be an understanding of its current position in terms of resources, limitations and environmental impacts. This information can be sued to make accurate and informed strategic decisions through techniques such as scenario modelling. It is prudent that this method for progress is adopted given the challenges posed by resource use and climate change.

The key findings of the project are;

- Partial or complete lack of data for some basic living requirements.
- A lack of coherent environmental data management.
- Strategic plans seemingly unsupported by an accurate evidence base.
- An increasing demand on resources despite a limited and declining supply.
- To date, relatively little leadership and influence from local government to change attitudes and behaviour.

Never before has local government had such an opportunity to work with business, regulatory bodies, NGOs and the third sector to secure the future of the County through reducing impact on the environment. This opportunity can only be realised if there is investment to ensure sufficiently high quality information to make accurate, credible and secure critical decisions for the future.

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1. INTRODUCTION

Understanding change requires detailed knowledge of current and past situations. Knowledge of historical anthropogenic impacts on Earth and its environment is limited and varied. Only in relatively recent years has the technology to accurately monitor and collect data about the environment been available. Whether it's the population of a particular species, the area of land covered by a habitat type or atmospheric composition, accurately knowing "what was" may be crucial for protecting "what will be".

As our understandings of the complexities of the environment have grown, so has our appreciation that it is more than just a resource bank to be exploited. Initially the most significant use of environmental data was economic, for example, identifying productive agricultural land, oil fields, finding sources of medicine, and building materials. In 2007 environmental data are still being used for economic purpose, but we have far greater understanding of the finite nature of many environmental resources and the complex ways in which environmental damage could threaten our very existence on Earth.

Many areas of the world, and Cornwall and the Isles of Scilly provide an excellent example; take full advantage of environmental quality for economic gains. During its industrial heyday Cornwall was a wealthy county, mining and selling tin from the rich veins which lay in the bedrock. Following the collapse of the tin mining industry an alternative was needed and again environmental quality was used but this time by tertiary industry. Given the geographical location of Cornwall and the difficulties of developing a competitive economy so distant from major markets, environmental quality has provided opportunities for economic prosperity, notably via tourism where scenic beaches, coastline and countryside all contribute to a successful industry.

This report will cover three key areas:

- The formalisation and quantification of baseline data and information surrounding key environmental issues in Cornwall
- Determine and understand the limiting factors to population and economic growth in Cornwall in terms of energy, land, food usage and others
- Determine the position and linkage of Cornwall in terms of Environmental sustainability against global impacts (including national and international relationships)

These three key areas will be addressed in the order they appear above, starting with the baseline conditions of Cornwall and Isles of Scilly and the impact of various sectors across the County. Depending on the sector, the impact is put into County-wide, regional, national or global context to highlight the scale of the issue.

2. GREENHOUSE GAS EMISSIONS

The Stern Review (2006) emphasised the need to reduce anthropogenic carbon dioxide (CO_2) emissions in order to address the rate of climate change and the implications for the global economy. The extent of the potential environmental and economic impacts is difficult to assess prospectively but there is a gathering of physical scientific evidence which supports a policy of urgent action. The Intergovernmental Panel on Climate Change (IPCC), the leading global authority on the subject, has monitored "*marked*" increases in atmospheric concentrations of carbon dioxide, methane and nitrous oxide emissions (see Figure 1).

"*Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level*" (IPCC, 2007).

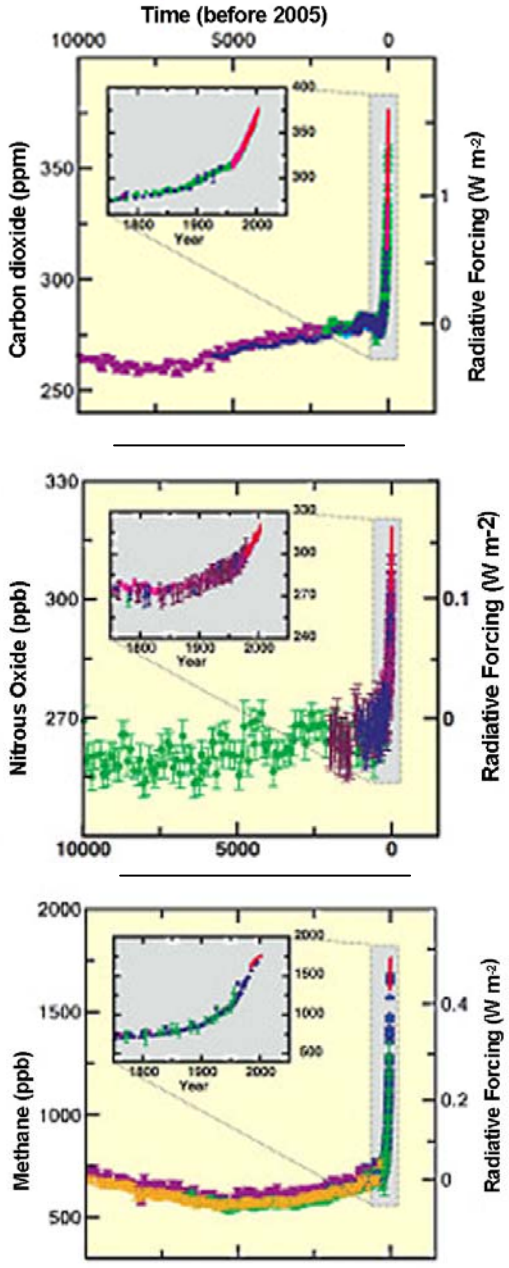
Emissions to air can separated into two categories; those which accumulate over long periods of time and are commonly associated with climate change e.g. carbon dioxide and methane, and those which have an immediate local impact on human and environmental health, and fall into the Government's National Air Quality Strategy (NAQS) (Section 2.9). This section will first review the global situation with respect to greenhouse gas emissions (and the recent dramatic rise in their concentrations) and then successively review the contribution to the global carbon dioxide budget by the UK, the South West region and Cornwall and the Isles of Scilly. The input from the three major sectors to which emissions can be attributed (industry, transport and domestic) will be considered at

various resolutions before reviewing individual carbon footprints and the impact of demographics. This section will also consider limitations to growth in Cornwall that are posed by emissions and their subsequent impact.

2.1. Greenhouse gasses – atmospheric concentrations

The subject of greenhouse gases is complex. Many of the gases referred to are naturally occurring and essential to life on Earth, but it is the increasing anthropogenic input of these naturally occurring gases (together with additional synthetic emissions) which is leading to climate change. Since the industrial revolution (~1750 AD) atmospheric concentrations of greenhouse gases have been increasing. This additional input of greenhouse gases into the atmosphere is saturating the natural sinks which only have the capacity to absorb naturally occurring greenhouse gases. Figure 1 displays increases in the atmospheric concentrations of carbon dioxide, methane and nitrous oxide over the last 10,000 years. Each graph shows a very similar trend with atmospheric concentrations increasing significantly since the commencement of the industrial revolution in Western Europe ~1750 AD.

Figure 1 - Atmospheric concentrations of carbon dioxide, methane and nitrous oxide in the past 10,000 years



Source – (IPCC, 2007)

The atmospheric lifetimes of the gases i.e. how long they will remain in the atmosphere is displayed in Table 1 below; using these data it can be seen that due to the lifetime of some of the gases, in particular carbon dioxide, peak concentrations will occur in the future even if all emissions were halted today. This is where the uncertainty lies as the exact relationship between peak concentration and changing ecosystem has yet to be understood. Stern's analysis (2006) of the economics of climate change suggests that the cost of reducing emissions are likely to be around 1% of global GDP if we take strong action now. The costs of failing to act now are considerably higher – 5-20% of global GDP.

Table 1 - Greenhouse gas lifetime

Gas	Lifetime (years)
CO_2 (Carbon dioxide)	5-200
CH_4 (Methane)	12
N_2O (Nitrous oxide)	114

Source – (DEFRA, 2003)

2.2. UK Greenhouse gas emissions

Emissions to air with a potential global impact include carbon, carbon dioxide, methane, nitrous oxide as well as synthetic pollutants like chlorofluorocarbon, hydrofluorocarbon and perfluoromethane which collectively are known as the "basket of six" (DEFRA, 2007a). The true impact of these emissions is uncertain and therefore attributing figures or tangible environmental impacts is fraught with difficulty and a reliance on modelling tools. The most recent evidence shows that the early models and predictions have grossly underestimated the rate of change and that the climate is in a worse situation than even the worst case scenarios had forecast. The salient message from the Intergovernmental Panel on Climate Change (IPCC) is that rate of change is happening faster than originally predicted and now the understanding of anthropogenic contribution to global warming and cooling has advanced sufficiently so that the IPCC have,

> *"Very high confidence (defined as >90%) that the globally averaged net effect of human activities since 1750 has been one of warming"* (IPCC, 2007).

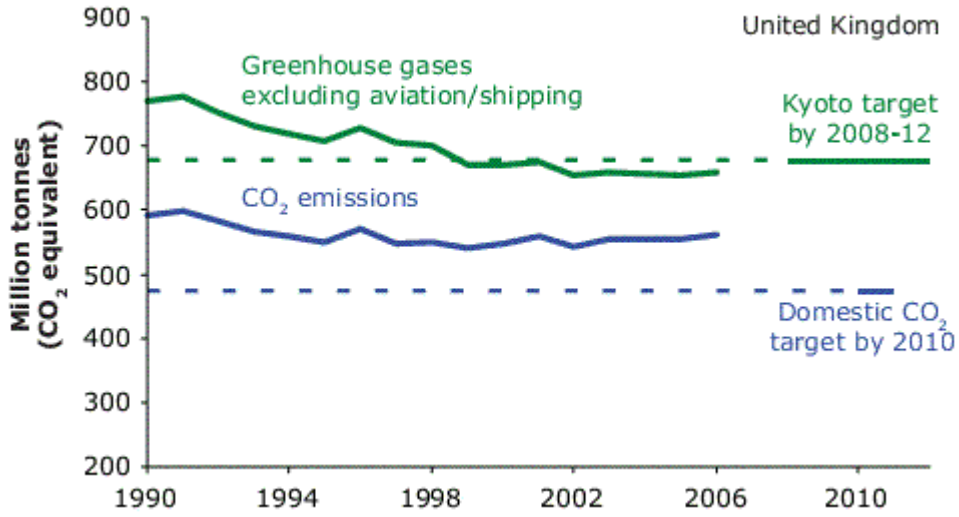
UK data are available for the "Basket of Six" but not all of them at county or district resolution. Of the data that are available for districts, methane is of particular interest. Due to the large dairy farming industry in Cornwall, methane emissions per capita in the County, and some districts in particular, are considerably higher than urban districts estimated elsewhere in the UK where agriculture is minimal. For example, methane emissions per capita in North Cornwall are 27 times higher than in the urban district of Greenwich in London. The significance of this is two-fold. First, the Global Warming Potential (GWP) of methane has been estimated at 21 times that of CO_2 over 100 years (DEFRA, 2007b). Second, much of the produce from the dairy farming industry in Cornwall is exported yet emissions are attributed to Cornwall even though it is supplying a demand beyond the political boundaries of the County.

2.3. UK Greenhouse gas emissions – Government indicators

The UK Government includes greenhouse gas emissions in its list of sustainable development indicators (DEFRA, 2007a) as well as in its new National performance indicators (NI 185*, NI 186**). Figure 2 shows the reduction of greenhouse gases, calculated to have been emitted from the UK between 1990 and 2006. When greenhouse gases are treated collectively, the current emissions from the UK meet the Kyoto target for 2008 – 2012. Figure 2 also shows how significant the carbon dioxide fraction of greenhouse gas is, and how when treated individually, domestic carbon dioxide is well above the Kyoto target for 2010.

*NI 185 CO reduction from Local Authority operations.
**NI 186 Per capita CO emissions in the LA area.

Figure 2 - Greenhouse gas emissions from the UK between 1990 and 2006



Source – (DEFRA, 2007a)

2.4. UK carbon dioxide – sector emissions

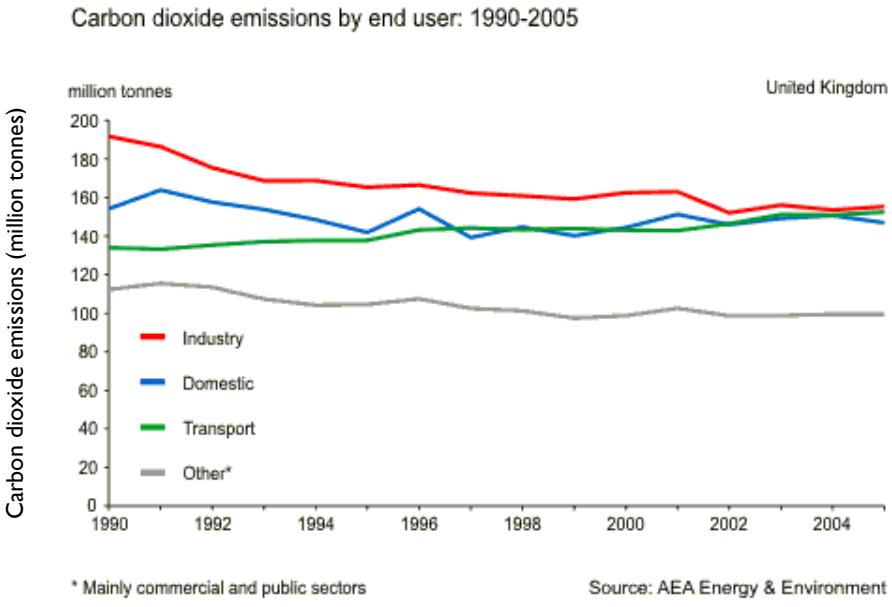
In 2005, total carbon dioxide emissions from the UK were estimated to be 554 million tonnes, the contribution from end users was;

- 28% industry
- 27% domestic
- 28% transport
- The remaining 14% is associated with commercial and public sectors

This is displayed below in Figure 3.

Source - (DEFRA, 2007c).

Figure 3 - Carbon dioxide emissions by end users in the UK between 1990 and 2005



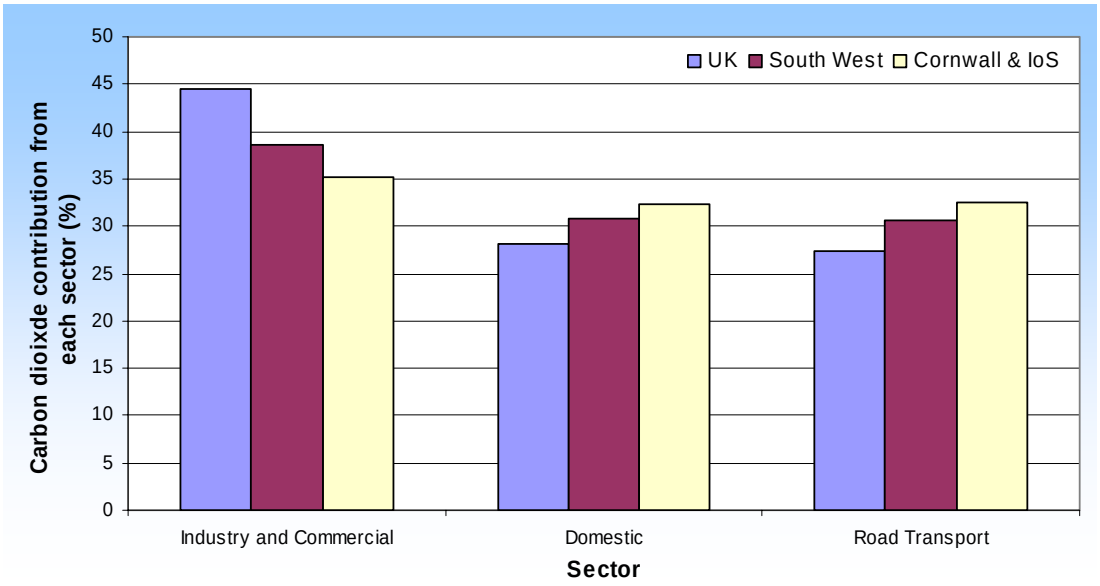
Source – (DEFRA, 2007c)

Figure 3 shows that a fall in carbon dioxide emissions from industry between 1990 and 2005 has stabilised at around 155 Mt yr $^{-1}$. The domestic sector emissions fell slightly from around 154 million tonnes to 147 Mt yr $^{-1}$ over the same period but emissions from transport show a steady increase from 134 Mt yr $^{-1}$ to 153 Mt yr $^{-1}$ (DEFRA, 2007c).

2.5. Carbon dioxide emissions in the UK, the South West and Cornwall and the Isles of Scilly - 2004

Of the 550 million tonnes of carbon dioxide emitted by the UK in 2004, the South West emitted a total of 42.9 million tonnes (7.8% of the total) with the contribution from Cornwall and the Isles of Scilly being 4.3 million tonnes (0.77 % of the UK total carbon dioxide emissions) (DEFRA, 2006a). Figure 4 compares the carbon dioxide contribution from sectors in the UK, the South West and Cornwall and the Isles of Scilly. Because carbon dioxide emission data produced by AEA Technology in 2004 is not comparable with previous carbon dioxide emission data for the UK (due to it being generated using a new method), long-term, historical trends for each sector cannot be identified.

Figure 4 - Carbon dioxide emissions (%) by sector in the UK and Cornwall and Isles of Scilly in 2004



Source – (DEFRA, 2006a)

The relative contributions from each sector differ in each geographical area. The data in Figure 4 shows the contribution from the industry sector in Cornwall and the Isles of Scilly at 35%, is less than the national average of 44%. The higher than national average emissions contribution from the transport sector in Cornwall could be linked to the rural nature and the high dependency on private transport has led to a greater dependency on private vehicles than else where in the country (see Section 7.6.1). The domestic sector is also responsible for a greater proportion of emissions than the national average, which may be a result of a combination of factors including demographics in the County (Section 2.8) and energy supply (Section 4.2.7) which are discussed later in the report.

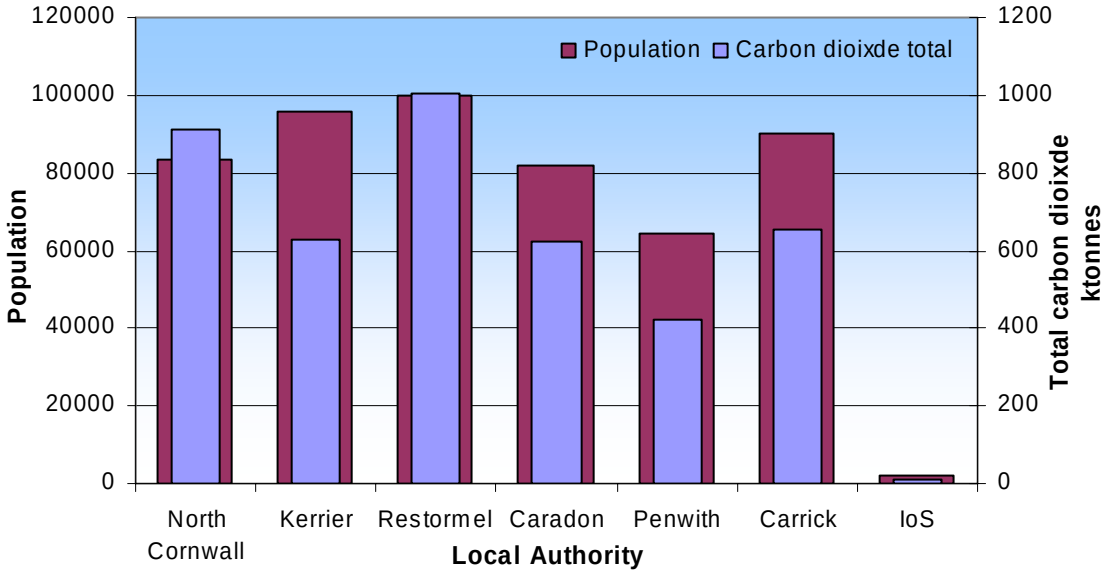
Household carbon dioxide emissions per capita in Cornwall and the Isles of Scilly are just above the UK average of 2.7 tonnes at 2.8 tonnes (DEFRA, 2006a). If the population in Cornwall grows from 519,400 in 2005 to 596,000 in 2021 and household carbon dioxide emissions per capita remain at the current 2.8 tonnes in Cornwall and the Isles of Scilly, the emissions will increase by 14.7%.

2.6. Carbon dioxide emissions from districts within Cornwall - 2004

With improved data collection methods and detailed local gas, electricity and road transport fuel consumption estimates, AEA Technology produced experimental carbon dioxide emission data for regions, districts and the

associated sectors. The data refer to 2004 and although due to the new method used to generate them, they cannot not be directly compared with data produced pre-2003 (this makes any trends difficult to identify with any degree of accuracy), there is a presumed increase in accuracy of the later data. Figure 5 uses new AEA data to compare carbon dioxide emissions for 2004 against population figures in the seven districts in Cornwall.

Figure 5 - Carbon dioxide emissions totals for Local Authorities in Cornwall and Isles of Scilly 2004 (not including land use change)



Source – (DEFRA, 2006a)

The data shows a range of 60% (400 Kt Penwith – 1000 Kt Restormel). There seems to be no rationale for this in relation to population so therefore the difference is likely to be attributed to the Industry and Commercial or Transport sectors.

2.7. Individual impact - carbon footprints

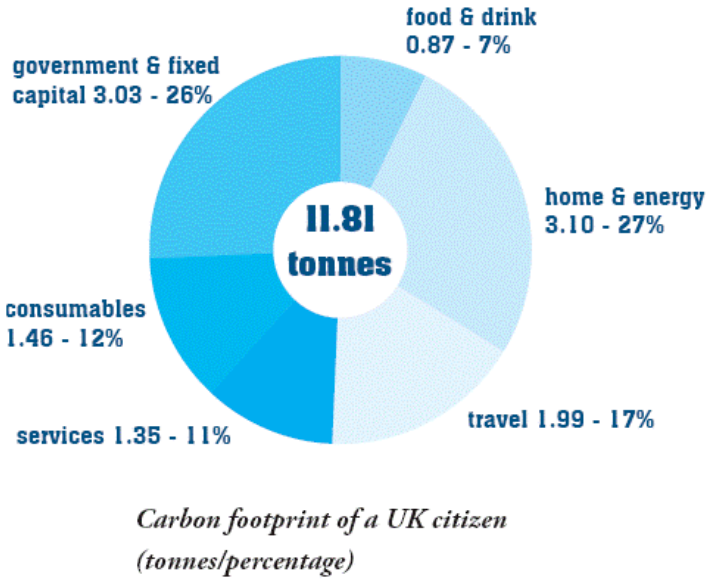
Carbon footprints are a measure of an activity's carbon emissions and the subsequent contribution to climate change i.e. the smaller the carbon footprint, the smaller the activity's detrimental impact on the climate. However, accurate measure of carbon emissions and their impacts is difficult to quantify, and the contribution made by an individual is essentially impossible to relate to negative global impacts. However, attempting to reduce carbon footprints produces collated effects which can make a tangible, positive difference to both the individual, the economy and energy resources. These differences generally stem from improved energy efficiency including turning off lights, not using standby functions on electrical appliances, taking public transport. Such measures will not only produce financial savings for individuals but also reduce energy demand, therefore putting less strain on the national energy supply. The Stockholm Environment Institute (SEI) (amongst others) has calculated the carbon footprint of citizens in the UK looking not only at the household energy demands but also the direct and indirect carbon dioxide emissions associated with the purchase of goods and services. The SEI has also taken the research one step further by looking at the carbon footprint of various demographics in the UK (Haq *et al*, 2007).

2.8. Carbon footprints – the impact of demographics

The Stockholm Environment Institute (SEI) undertook a comprehensive study of the carbon footprint of UK citizens, separating the results into various demographic groups. The study looked at not only the classic activities associated with carbon emissions i.e. energy consumption and travel, but also the purchase and disposal of goods and services which have direct and indirect emissions. The full suite of activities included in the study

can be found by downloading the report from the SEI online at http://www.sei.se/editable/pages/sections/implement/ClimateChangeandOver50s.pdf.
The study found that the average carbon footprint of a UK citizen per year was 11.81 tonnes of carbon dioxide, the breakdown of which can be seen in Figure 6.

Figure 6 - Average UK citizen carbon footprint as calculated by the Stockholm Environment Institute

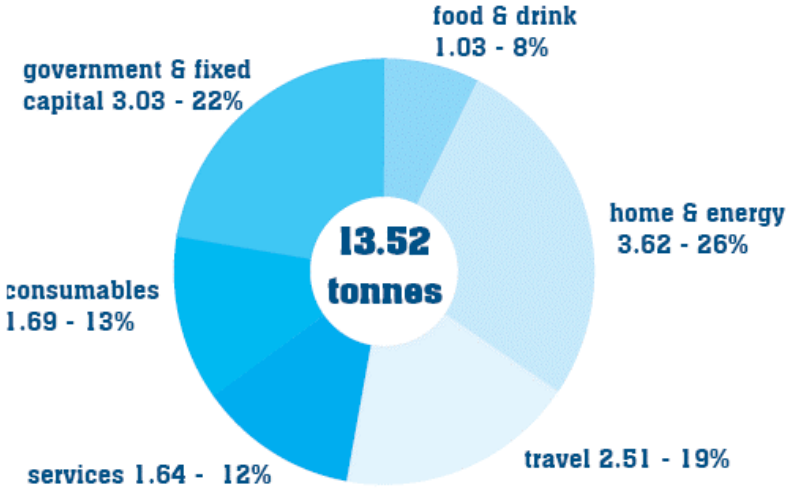


Carbon footprint of a UK citizen (tonnes/percentage)

Source – (Haq *et al.* 2007)

The SEI results revealed how the demographic with the biggest carbon footprint is the "baby-boomer" generation (50 – 64 years of age). The average carbon footprint of a baby-boomer is 13.52 tonnes, 1.71 tonnes of carbon dioxide more per year than the average UK citizen (see Figure 7).

Figure 7 - Average UK baby-boomer (50-64 years of age) carbon footprint as calculated by the Stockholm Environment Institute



Carbon footprint of a baby boomer (tonnes/percentage)

Source - (Haq *et al.* 2007)

The implications of the various carbon footprints associated with each demographic are significant for the UK and Cornwall and the Isles of Scilly. Cornwall's largest demographic group is between 45 – 59 years old and makes up

22% of the resident population (Section 12.4) compared with a national average of 20.3%. Therefore a significant proportion of the population has a larger than average (using SEI data) carbon footprint. The third largest demographic in Cornwall (65-79 which constitutes 14% of the county's population) has the second largest carbon footprint of 12.1 tonnes of carbon dioxide. In addition to the resident population, the demographics of the tourist population will also have an impact. The Cornwall Visitor Survey 2006/07 (http://www.cornwalltouristboard.co.uk/documents/CVS0607FULLREPORT.pdf) undertaken by the Cornwall Tourist board, identified 42% of visitors to the County are over the age of 55 and, 58% over the age of 45. As stated above, this demographic has a larger carbon footprint than the younger demographics so have a greater environmental impact. The Cornwall Tourist Board and the industry in the County needs to be aware of the impact their clientele is having.

The study by Haq *et al* (2007) identified the aspirations of many of the 50+ generations who wish to reduce their impact on environment or at least to reduce their energy use which will have the a similar effect. All three of the recommendations made in the study require support from the Government.

- Reducing household emissions by improving energy efficiency. This requires financial support due to current energy saving technology requiring significant capital in exchange for slow pay back times.
- The desire to move from private cars to public transport can only be achieved with significant investment from the Government. This is especially true for a rural county such as Cornwall.
- A move to reduce packaging needs support of legislation from Government to give the consumers what they want i.e. less domestic waste.

2.9. Local air quality – the National Air Quality Strategy

Given the potential climate change associated with anthropogenic emissions, greenhouse gases (and carbon dioxide in particular) dominate the focus of attention of both the media and scientific research. However, more immediate and local impacts are associated with several other emissions to air which are included in the Government's National Air Quality Strategy (NAQS). These pollutants include those from transport and industry such as nitrogen oxides, particulate matter and sulphur dioxide amongst others. The NAQS sets out objectives which must be met by Local Authorities who have a statutory duty to review and assess air quality in their district under the Environment Act 1995 (DEFRA, 2007d). The impact of these emissions to air, as opposed to greenhouse gases, is linked with personal exposure and the NAQS objectives have been set with human health in mind (DEFRA, 2007d). Due to the lack of industry and relatively small population, air quality in Cornwall, in terms of human health is generally good. There are however small areas where a number of contributing factors including population growth and the associated traffic growth (Section 7.2) has led to pollution hotspots.

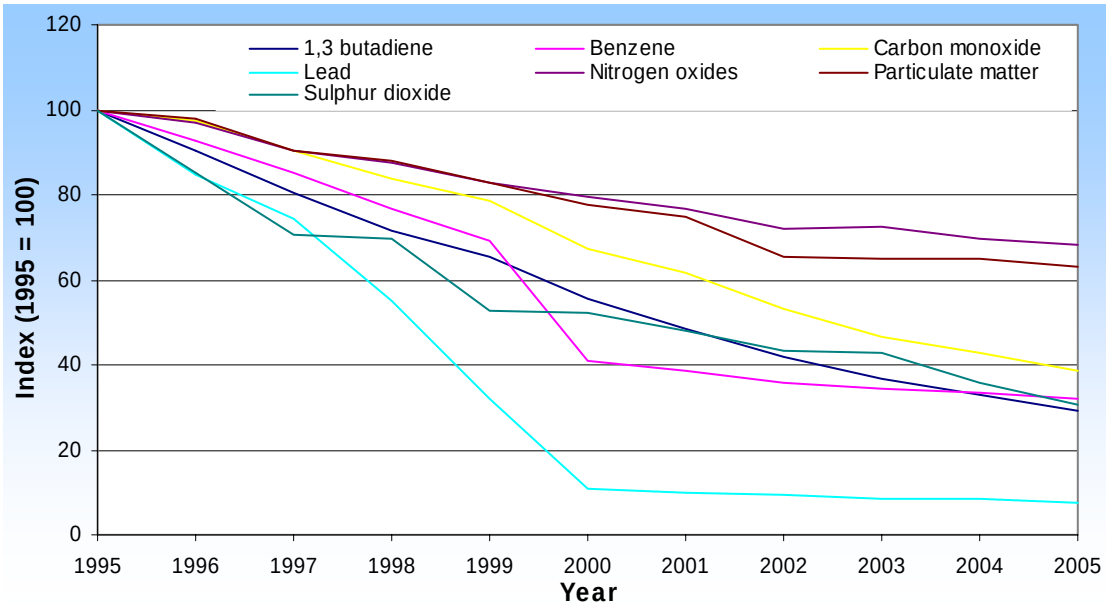
In a report produced by Park *et al.* (2004) it was estimated, using a national income model, that a 1% increase in income (something which could also correlate with increased population) would result in a 1.35% decline in air quality. If, as is the case in many pollution "hotspots" in Cornwall, the air quality is already close to the statutory limit, a small decrease in air quality could lead to a breach of the limit and result in the costly exercise that is the declaration of an Air Quality Management Area.

The following Sections review and compare the situation in the UK and Cornwall and the Isles of Scilly in relation to the UK NAQS.

2.9.1. Emissions of National Air Quality Strategy pollutants in the UK

Emissions data are available from the National Atmospheric Emissions Inventory (NAEI) data warehouse online (www.naei.org.uk). Data are separated by United Nations Economic Commission for Europe (UNECE) sectors and emissions are modelled on a 1 km^2 resolution. Figure 8 below looks at the decline in emissions of the pollutants which fall under the NAQS objectives. The decline of all seven pollutants is clear to see and stems from improved technology and tighter legislation enforced by the Environment Act 1995.

Figure 8 - Emissions of pollutants included in the UK Government's National Air Quality Strategy



Source – (NAEI, 2007)

Despite the national decline of the emissions in Figure 8, some isolated areas (hotspots) have pollution concentrations in breach of the NAQS objectives. The following section looks at these pollution hotspots and the statutory requirements to mitigate them.

2.9.2. Air Quality Management Areas

Air Quality Management Areas (AMQAs) are a management tool consequent on local air quality failing to meet the Government's National Air Quality Strategy (NAQS) objectives (DEFRA, 2007d). Where Local Authorities identify air quality within their boundaries which is deemed unsafe for human exposure, an AQMA must be declared. Following the declaration of an AQMA the Local Authority has a statutory duty to produce an Air Quality Action Plan that outlines actions that will mitigate the unsafe air quality. AQMAs tend to be located where a number of factors combine to cause exceedences of the NAQS objectives. These factors include, volume of traffic, traffic speed, road gradient, surrounding topography and local weather conditions. The transport infrastructure of Cornwall was designed many years ago around the existing many small market towns. The geographical size and population of many of these towns have grown considerably without the appropriate improvements to the transport network being made. This has resulted in congested narrow streets where pollution levels in some areas are close to statutory limits and in (at least) one area the limit has been breached.

In 2007, 214 AQMAs had been declared in the UK, 28 of those in the South West and just one in Cornwall (a second declaration is imminent and is currently in consultation) (AEA, 2007). The single AQMA declaration in Cornwall is in Kerrier DC and is due to breaches of the NAQS annual objective for nitrogen dioxide (Kerrier DC, 2007). The elevated concentrations of nitrogen dioxide in Kerrier DC are a result of congested traffic; a source of nitrogen dioxide. These high concentrations of nitrogen dioxide are also indicative of the presence of elevated concentrations of other pollutants including respirable particulate matter, benzene and, sulphur dioxide.

If population and traffic continues to increase the number of pollution hotspots and Air Quality Management Areas (AQMA) are likely to increase. The declaration of an AQMA is an expensive process for the Local Authority concerned, as mitigation measures and traffic engineering schemes need to be employed to remediate the situation.

2.10. Emissions to air – Environmental impact

Pollutants such as nitrogen oxides and ozone that are typically associated with human health impacts (both appear in the Governments NAQS objectives, see Section 2.9) also have detrimental effects on habitats and crops. The primary source of the aforementioned pollutants is combustion. Increases in the concentration of nitrogen oxides leads to increased nitrogen deposition on the surrounding land. The impact this has depends on the vegetation type but the most "at risk" include heaths, moors and semi-natural grasslands all of which exist in Cornwall. Due to the complex nature of the relationship between nitrogen deposition and vegetation "response", it is very difficult to quantify and forecast the impact of increasing nitrogen oxide concentrations stemming from increased traffic. Research in the last 20-years has identified several areas in the UK where nitrogen deposition has affected the vegetation cover. The change in vegetation and therefore habitat could result in a chain of effects which result in altered biodiversity. The proposed Land Mapping Project (see Section 5.5) would help identify change in Cornwall which could occur if traffic projections are accurate (See Section 7.2, Figure 27).

Ozone is not a direct emission from motor vehicles but is the result of reactions between nitrogen oxides and hydrocarbons (also from combustion) in the presence of sunlight. Ozone can form hundreds of miles from source often leaving the affected area powerless to mitigate the situation. Cornwall and in particular the Lizard peninsula suffers from high concentrations of ozone during the summer months as pollutants from the continent react over the English Channel before hitting the mainland. High concentrations of ozone will reduce crop yield resulting in economic losses and potentially higher food prices on the high-street. There is little that can be done about the situation other than to recognise and minimise the County's own contribution towards ozone concentrations beyond its political boundaries.

2.11. Emissions to air – summary

- Cornwall has a responsibility to minimise carbon emissions to minimise its contribution to global climate change.
- Increases in population and growing economic wealth are strongly correlated with an increase in greenhouse gas emissions. The challenge for Cornwall in reducing its emissions is thus compounded.
- Cornwall's aging population has a higher than average carbon footprint. Active support is required to minimise this disproportionate impact.
- Investing in energy reduction strategies and diversifying the energy supply to Cornwall could reduce the carbon dioxide emissions from the domestic sector.
- Reducing emissions to air will reduce the environmental impact in Cornwall.
- By reducing carbon dioxide emissions Cornwall and the Isles of Scilly can sustain its image as a "pathfinder" county. This could be used as a marketing tool to promote the County.

3. WATER (DOMESTIC SUPPLY)

As the population of the UK and in particular Cornwall increases and, hot, dry summers are predicted to increase in frequency (IPCC, 2007), the demand on fresh water supplies for drinking, sewerage services and agriculture will rise. In 2003 the record breaking summer temperatures saw water demand in some areas at its highest for the last eight years. Thames Water supplied 300 million litres more than the average daily supply to London on August 6th 2003. (BBC, 2003). However, in 2007 the opposite weather conditions, the wettest summer since 1914 (Met Office, 2007a) also caused "drought" conditions as flood water entered water treatment plants causing them to fail which, at its peak left 350,000 people without a water supply (BBC, 2007a). This demonstrated the vulnerability of the UK's water supply network and how climate change could make water supply strategies difficult to construct given the unpredictable weather patterns. Domestic water consumption is number 16 in the Government's sustainable development indicators guide (DEFRA, 2007a).

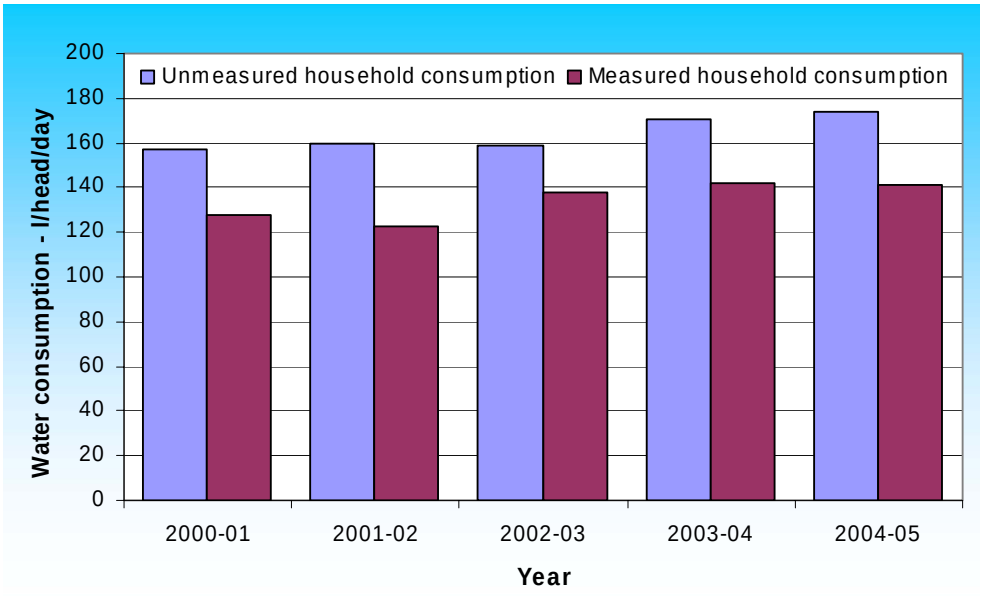
Whilst it may be possible to forecast annual and even monthly water demand accurately for some parts of the UK given the stable and predictable population fluxes, Cornwall and the Isles of Scilly face a significant challenge. Not only is the resident population increasing at a rate which is much faster than the national average (see Section

12.1.1) but there is also the issue of the tourist population which during the peak week of the tourist season increases the population by approximately 270,000 (more than half the resident population). The implications of this and other factors affecting water demand are discussed further in the following sections.

3.1. Water – household consumption in the South West Water area

Water consumption data are available for the South West Water area as a whole. This includes Cornwall, Devon and small parts of Somerset and Dorset (see Figure 10). Water consumption figures are estimated for measured and unmeasured households as litres per head per day (l/head/d). Households with a measured (metered) water supply, used on average 18% less than households with unmeasured water supply over the 5-year period between 2000 and 2005 (Figure 9). This is an indicator that personal financial incentive can reduce water demand. Some forecasts predict the price of water will triple in the next few decades if the demand from the growing population is to be met (RSC, 2007). This will undoubtedly change the way in which we use water and will also put significant strains on industry and agriculture.

Figure 9 – Estimated* household water consumption (l/head/day) in unmeasured and measured properties.



*Estimated excludes underground supply pipe leakage.
Source (OFWAT, 2005)

3.2. Per capita consumption in the UK and Cornwall

Average water consumption per capita in the UK fluctuates dependent largely on summer weather. The UK average in 2005 was 151 litres per day (DEFRA, 2007a). Due to the potentially misleading nature of Per Capita Consumption (PCC) data, the figures for the SSW area cannot be produced here. *"Qualitatively PCC in the SWW region is slightly higher than the national average which is most likely due to demographic differences in the South West"* (Merchant, *Pers. comm.*). PCC data is available for stakeholders who require a reference point (Tynemarch, 2007). If Cornwall County Council choose to use the REAP model to calculate the Ecological Footprint of the County (Section 19), PCC data will be required. This data will also be important to the significant housing growth in Cornwall (Section 8.6) if minimum environmental impact is to be achieved. The Government document Code for Sustainable Homes (http://www.planningportal.gov.uk/uploads/code_for_sust_homes.pdf) includes various PCC targets for new homes, the lowest grade (one star) requiring 120 l/p/d. This needs both the water efficiency of the house and the occupant to improve significantly on the current average.

3.3. Water - supply/capacity in Cornwall

Calculating water demand for a complete county is difficult due to the location of reservoirs and where water is distributed (often dictated by geographical elements). However, in Cornwall the Colliford Strategic Supply Area (SSA) covers the County almost perfectly with the exception of the north east (Figure 10). Tables 2 and 3 below, detail the current and forecast water available for use and demand in the Colliford SSA. The predicted demand in 2010/11 is 150.58 million litres per day. This exceeds the current water available for use (WAFU) which is 146.51 million litres per day. The demand is forecast to rise to 160.06 million litres per day in 2020/21 (SWW, 2005). To counter this increased demand SWW has "*acquired Park Lake on Bodmin Moor to increase the resources*" (Paul Merchant, SWW Demand Strategist, *Pers. comm.*) and is also implementing other resource schemes to ensure the demand is met.

Table 2 - Water distribution input and water available for use in June 2007

Colliford Strategic Supply Area	Millions of litres per day
Average daily distribution input (06/07)	142.47
Water available for use	146.51

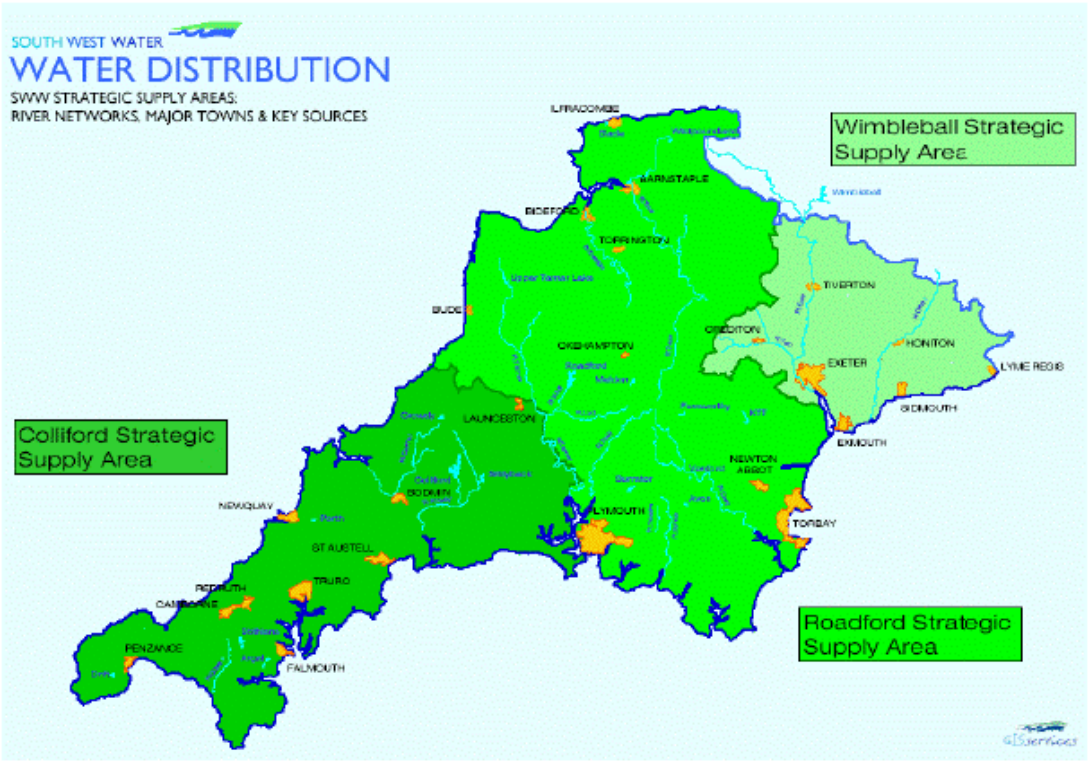
Source – (Paul Merchant, SWW Demand Strategist, *Pers. comm.*)

Table 3 - Water demand forecast for the Colliford SSA – millions of litres per day (dry years)

Year	Distribution input	Headroom	Total
2010/11	140.63	9.95	150.58
2015/16	143.21	11.28	154.49
2020/21	147.27	12.79	160.06

Source – (Paul Merchant, SWW Demand Strategist, *Pers. comm.*)

Figure 10 - Water distribution strategic supply areas including Colliford



Source – (SWW, 2005)

3.4. Water – supply constraints

Section 3.5, highlights the variable demand for water that stems from the influx of tourists during the summer period. Not only is the seasonal demand variable but so too is the geographical demand within the County as some areas attract more tourists than others. The limit to the supply is governed by one of two things depending on the area;

- The maximum output of the water treatment works
- The ability of the distribution system to convey the water to the areas in which it is needed.
- Availability of raw water
- Maximum allowed abstraction from raw water sources under SWW's abstraction licences (granted by the Environment Agency

Which of these factors limits the ability to supply peak demands will vary according to how the demand is distributed throughout the area. In some parts of the region the distribution system will have enough capacity to cope with large increases in demand so it will be the treatment works capacity that is the limiting factor, whilst in others areas the distribution system will be the constraint (SSW, 2007).

3.5. Water – variable demand and tourism

The South West region and in particular Cornwall and the Isles of Scilly have a large variation in population throughout the year due to its popularity as a tourist destination. During the peak-week of the summer tourist season, the population in Cornwall and Isles of Scilly is increased by more than 50% as approximately 270,000 tourists temporarily reside in the County (LINC, 2006). The number of tourists visiting the area is difficult to predict as the weather plays an important role. Sunshine and warm temperatures will inevitably result in more tourists visiting the County and as a result of the good weather, demand on water increases from both residents and tourists. Add to this the fact that less rain will be falling into the reservoirs in good, dry weather conditions, the ability to supply the water to the increased demand becomes strained. The peak demand during the year is expected to coincide with the busiest periods i.e. when tourists number swell the County population, but no data was available to support this. It is essential that the infrastructure to deal with these scenarios is in place if Cornwall and the Isles of Scilly are going to survive and succeed economically, socially and environmentally. The financial burden of providing this essential public service to a temporarily increased population is reflected by the regions combined water and sewerage rates which are the highest in the UK (Water Guide, 2007).

Due to the location of tourist water consumption i.e. at commercial sites such as campsites and attractions, the PCC is difficult to calculate. Work being undertaken by Coast (Cornwall Sustainable Tourism Project) may be able to identify this figure which will provide a reference point and therefore a target for reducing the impact of one of the County's largest industries. This is significant given the industry's aspirations to extend the season in order to increase economic benefits and improve the job opportunities for the County (Cornwall Tourism Focus Group, 2000) whilst at the same time climate change forecasts predict drier summers (IPCC, 2007).

Every 5 years as part of the '*Periodic Review*' process each water company must submit a Water Resources Plan to OFWAT and the Environment Agency. To complete the plan companies must show how they will fulfil the forecast demand for water in their region over the next 25 years. These plans must satisfy the regulators and are rigorously audited by independent auditors, they are also updated annually.

To complete the plan SWW undertake thorough modelling of the supply demand system. This modelling requires very detailed demand forecasts to be produced taking into account (the following list is not exhaustive):

- Population change
- Changes in per capita consumption (in both metered and unmetered households)
- Demographic changes (such as the trend towards smaller households)
- Changes in commercial demand (including predicted changes in tourism)
- Climate change
- Variation in demand through the year (including peak demands)
- Regional variation in demand
- The effect of water efficiency measures
- The rate of customers switching to metered billing
- The effect of SWW policy on demand

These demands are then used as an input to a very complex water resources model which is used to test how our system is able to cope with the projected demands through a wide variety of climatological conditions. The model takes into account all constraints and highlights where we might not be able to meet rising demand in the future. Where a future demand shortfall is forecast, capital schemes (or demand management measures) are identified to enable this shortfall to be met. The identification of future shortfalls and planning to eliminate them is the primary function of the Water Resources Plan (Merchant, *Pers. comm.*)

3.6. Water (domestic supply) - summary

Demand in Cornwall has recently surpassed the supply capacity which had been put in place. A combination of increasing capacity, improving resource efficiency and demand management has resolved this issue however, this is a clear indication of growth in Cornwall and an early indication of a potential limit. Options to resolve this situation include:

- New water storage capacity has been secured at Park Lake in Bodmin (as well as additional resource schemes) to meet the growing demand although the capacity of this resource and the length of time it can meet the demand could not be identified in this report. Natural storage capacity is, however, finite and efficiency must be improved.

- Encouraging more efficient water use by the end user. Installing water meters has been proven to reduce usage compared to un-metered households (18% higher in un-metered households in 2004/05) yet the demand in metered households has still increased by nearly 10% in the period between 2000/01 and 2004/05 (OFWAT, 2005).

- Reduce water leakage by improving the supply infrastructure. In 2006/07 leakage in Colliford SSA averaged 25.26 Ml/d, compared to a distribution input of 142.67 Ml/d, equating to 17.7%. This is however below the current Economic Level of Leakage, meaning it would cost more to improve the infrastructure than the value of the water saved.

- Water storage capacity could be increased by artificially constructing reservoirs. However, this practice has numerous disadvantages including the cost of construction, environmental impacts, the availability of land suitable for such a scheme and the increased rise in water bills as a result of the expensive installation.

- Understand the tourist impact on water supply to enable evidence based strategic plans to be made.

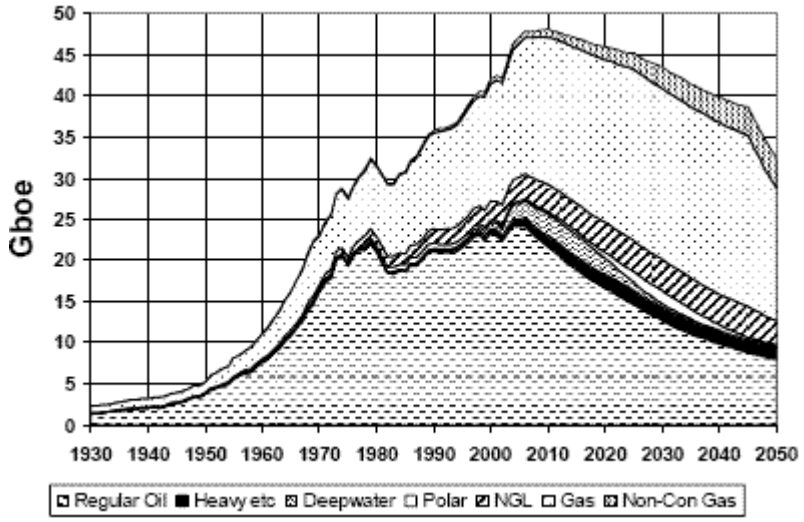
4. ENERGY

Unless it is from clean, renewable sources e.g. wind or tidal, energy generation involves either nuclear technology, which has a plethora of environmental impacts associated with the process and eventual decommissioning or, energy is derived from the burning of fossil fuels, which releases emissions which contribute to climate change. As parts of the world begin to seek ways of reducing emissions and their impact on the climate, energy use and generation is being researched as a way of making significant reductions. There is also a need to seek alternatives to fossil fuels such as oil, as the global sources are finite and cannot keep up with the continuing and growing demand for energy. The impending issue that is Peak Oil is defined by Colin Cambell, founder of the "Association for the Study of Peak Oil and Gas" as,

> *"The maximum rate of the production of oil in any area under consideration, recognising that it is a finite natural resource, subject to depletion"*, (http://www.peakoil.net/).

The exact point at which "peak oil" occurs is the subject of much debate but, whenever it does occur, the impact on the way in which the world's society operates will be significant. The greatest repercussions of falling oil supply are likely to be on energy and goods production; both crucial to modern day life. Figure 11 illustrates the global supply of oil and gas, indicating peak oil will occur around 2010.

Figure 11 - Oil and gas depletion, 1930 - 2050



Source – (Hopkins, 2005)

The effect of Peak Oil in ill prepared societies could be catastrophic. Cornwall is part of a society that is reliant on oil for its industry, business and pleasure. Early preparation and long-term planning will help make the transition to alternative sources of energy much easier. In a report by Hirsch *et al* (2005), the time taken to make a transition to an alternative fuel in the USA was estimated at 25-30, hence the need to act *before* we enter a crisis.

Steps to make the transition easier and successful include;

- develop a sustainable and secure energy supply from renewable sources
- consider procurement policies and sourcing resources locally rather than relying on transport intense imports,
- ensure new developments make best use of energy efficient technology and where possible incorporate renewable energy technology

If changes are not made and Cornwall continues to rely on fossil fuel (at current prices), the financial cost of production and consumption will rise to a point where business and industry may no longer be able to compete with larger international companies who can absorb rising energy costs. The rising cost of services and products

could also result in many people no longer being able to afford basic amenities such as heating (Section 4.4), and transport access to health care and education. The list of potential impacts is vast and this report only gives a few examples, but as previously stated, the social and economic impact could be catastrophic.

4.1. Energy gap

"Britain is facing an energy supply shortfall in the near future" (BBC, 2005a). The imminent closure of nuclear and coal power stations across Britain coupled with the requirements to reduce carbon emissions will result in the generation of electricity falling to approximately 80% of the demand. This could be particularly significant in Cornwall and the Isles of Scilly where 33% of the energy used in the domestic sector is from nuclear and coal power stations in the form of grid electricity compared to 20% nationally (BERR, 2007a). This leaves the County more vulnerable to supply security and price as for many, alternatives are not available.

The energy gap could be filled simply by building new coal and gas power stations but this contradicts the Government's aspirations to reduce emissions which could contribute to climate change. The solution to the national energy supply gap includes a target to generate 40% of the electricity demand from renewable sources by 2050 but there must be investment in the technology to make this viable. This again may be prudent for Cornwall and the Isles of Scilly where renewable energy technology is already being used and expanded. The development of renewable energy supply could increase the security of the energy supply and prove economically lucrative in what is a developing and increasingly important sector. Local financial instruments should be designed to make Cornwall and the Isles of Scilly economic area favourable to capital investment in such technology – particularly in relation to start up, planning, capital, and resource use.

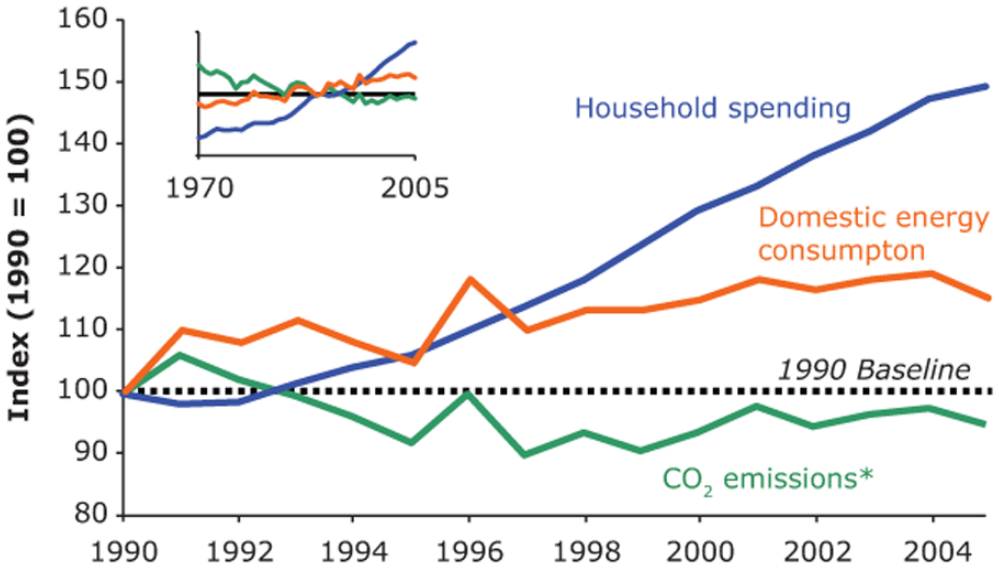
4.2. Energy consumption

As mentioned previously, energy use has a direct effect on emissions as well as cost. By improving energy efficiency and reducing consumption it may be possible to decouple the relationship between the economy, energy generation and emissions thus mitigating the impact of a growing population and demand. The following sections review the energy consumption of various sectors in the UK at varying resolution.

4.2.1. National energy consumption trends

Energy consumption in the UK has shown some fluctuations from a consistent growth path in the period between 1970 and 2005. UK energy consumption in 2005 was at a record high of 234.3 million tonnes of oil equivalent. The Government uses household energy use as a sustainability indicator (number 6 – Household energy use) which is displayed in figure 12 below.

Figure 12 - UK household energy use - 1990 - 2005

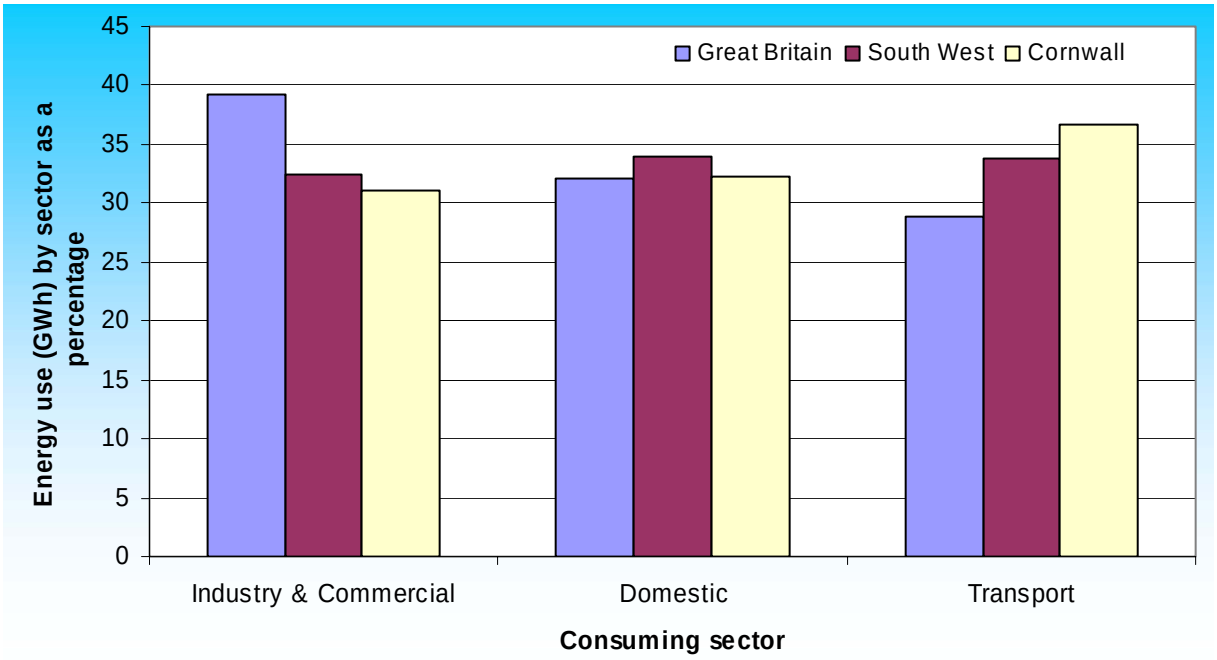


Source – (DEFRA, 2007a)

4.2.2. GB energy consumption by sector

The Department for Trade and Industry (DTI) produces total energy consumption figures for regions and Local Authorities across the UK. Total consumption in GB in 2004 was 1.8 million GWh. Figure 13 below shows the consumption figures (separated by sector) for GB, the South West and Cornwall. The data have been presented as a percentage of the total energy use for each area.

Figure 13 - Energy consumption (GWh) by sector in GB, the South West and Cornwall as a percentage of the total for the area



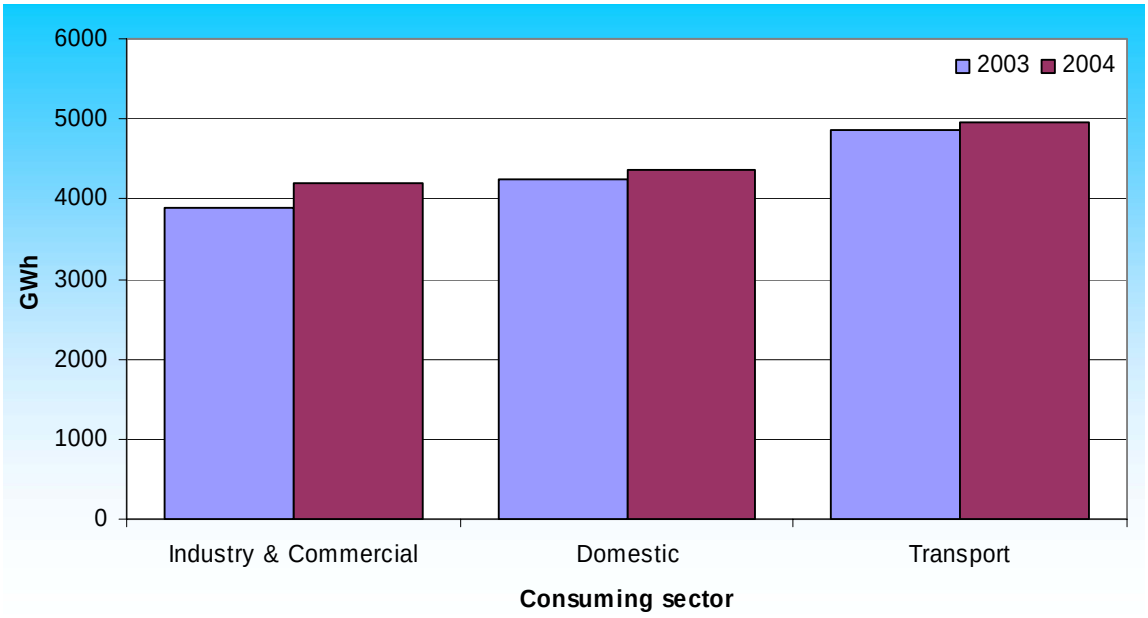
Source - (BERR, 2006a)

Figure 13 shows the difference in energy consumption by each sector in each geographical area. In a similar trend to carbon emissions (Figure 4), energy use by the industrial & commercial sector in Cornwall is lower than GB average whereas energy use by the transport sector is 8% higher than the GB average.

4.2.3. Cornwall energy consumption by sector

Figure 14 displays the energy consumption in Cornwall and Isles of Scilly for 2003 and 2004. It clearly shows an increasing energy demand by all sectors with transport using 37% of the energy demand in 2004. The total energy demand in Cornwall and the Isles of Scilly in 2004 was 13505 GWh, a 3.8% rise on the 2003 total of 12989 GWh.

Figure 14 - Energy consumption in Cornwall and Isles of Scilly for 2003 and 2004 by consuming sector



Source – (BERR, 2006a – *Reproduced under the terms of the Click-Use license*)

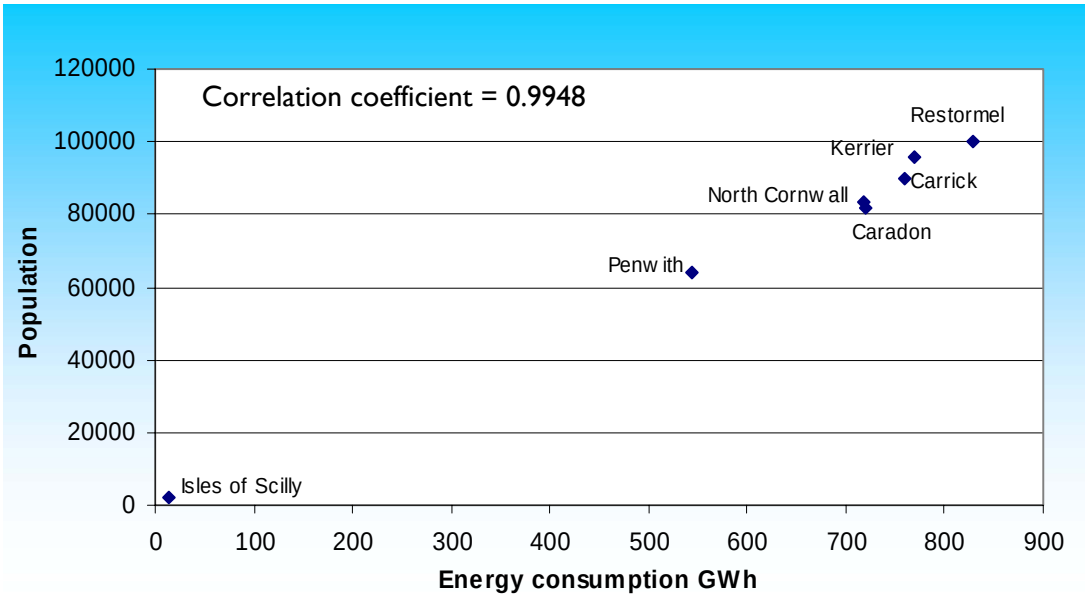
Energy demand in Cornwall and the Isles of Scilly is rising, the result of a combination of factors including population increase, individual demand increase and an aging demographic profile. In 2004 and with a population of 517,000 the total energy use in Cornwall and the Isles of Scilly was 13,505 GWh of which 4,353 GWh were attributed to domestic use (DTI, 2006a). With the population in Cornwall predicted to reach 596,000 by 2021 (a 15% rise on 2004 population figures) the energy demand from the domestic sector alone could rise to approximately 5081 GWh.

If population growth and subsequent energy demand continue unchecked, Cornwall and the Isles of Scilly will move into an increasingly vulnerable position. The County's economy, transport and social system will be at the mercy of price and supply variation.

4.2.4. Energy consumption – districts in Cornwall

Figure 15 below illustrates the relationship between energy consumption and population size of all districts in Cornwall in 2004. Energy consumption performance is very similar in each district with a close relationship between population size increase and energy consumption increase (correlation coefficient = 0.9948).

Figure 15 - Energy consumption and population size of all Local Authorities in Cornwall in 2004



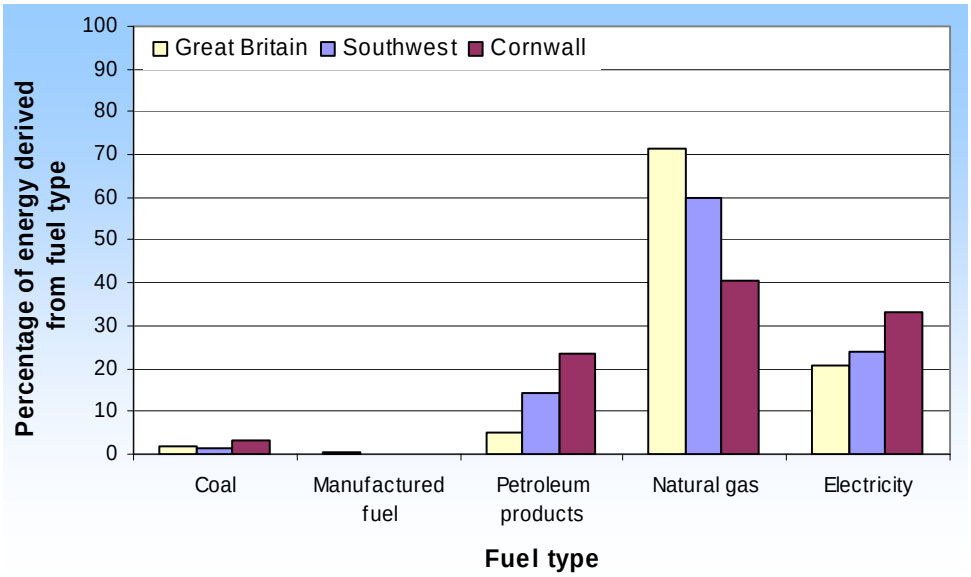
4.2.5. Energy demand in Cornwall and the Isles of Scilly and the forecast population increase

With the forecast rise in population and a shift in demographic profile in Cornwall and Isles of Scilly, the demand for energy will increase. In 2004 and with a population of 517,000 the total energy use in Cornwall and the Isles of Scilly was 13,505 GWh of which 4,353 GWh were attributed to domestic use (BERR, 2006a). With the population in Cornwall predicted to reach 596,000 by 2021 (a 15% rise on 2004 population figures) the energy demand from the domestic sector alone could rise to approximately 5081 GWh if it continues business-as-usual.

4.2.6. Domestic energy consumption by fuel type in Great Britain, the South West and Cornwall and the Isles of Scilly in 2004

The majority (70%) of domestic energy consumption in Great Britain (GB) stems from the use of natural gas (Figure 16). In the South West natural gas use is 59% of domestic energy use with a higher proportion (over the GB average) of energy derived from electricity and petroleum products. Deviation from the GB average increases even further when Cornwall and the Isles of Scilly specific domestic energy use is analysed. Natural gas is responsible for just 40% of energy consumption whereas electricity use is 33%, 13% higher than the GB average a result of the poor gas infrastructure supplying Cornwall (German, 2006). This has a direct impact on the carbon footprint associated with the energy supply in Cornwall and the Isles of Scilly. Table 4 details the carbon dioxide emissions associated with various energy sources: grid electricity produces more than twice the amount of carbon dioxide that natural gas does (Energy Saving Trust, 2006). This makes Cornwall a poor performer with regard to its carbon footprint and energy supply yet there is very little choice for alternatives (see Sections 2.3 and 2.4 for further discussion of Cornwall's carbon emissions).

Figure 16 - Domestic energy consumption by fuel type in Great Britain



Source – (BERR, 2006a – *Reproduced under the terms of the Click-Use license*)

4.2.7. Fuel type and associated emissions

The UK energy supply comes form various fuel types and each has its advantages and disadvantages in terms of economic and environmental impact. One of the main advantages of having numerous energy sources is that the Country is not dependent on one source and, in theory changes in global energy supply could be compensated for by increasing the use of other fuels. Table 4 below looks at the carbon (and carbon dioxide) emissions associated with different fuel types and clearly shows the biggest impact comes from grid electricity. This doesn't take into account the impacts of acquiring the fuel e.g. the impact of oil and gas extraction, transportation etc.

Table 4 - Fuel type and associated emissions

Fuel type	Kg CO_2/kWh	Kg C/kWh
Grid electricity	0.43	0.117
Natural gas	0.19	0.052
Gas / diesel oil	0.25	0.068
Coal	0.30	0.082
Liquid petroleum gas	0.21	0.057

Source – (Energy Saving Trust, 2006)

4.2.8. Energy consumption – the impact of demographics

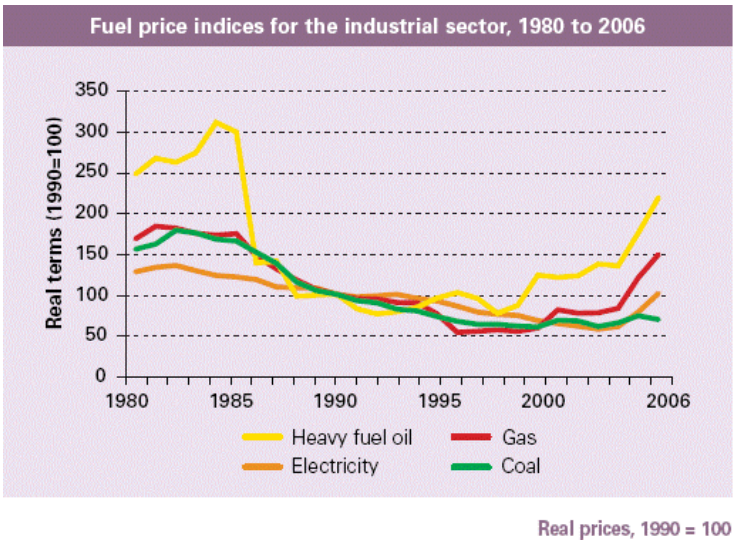
As previously mentioned in Section 2.8, demographics can affect the emissions and carbon footprint of an individual and in areas where the 50+ demographic makes up a significant proportion of the population, the whole area could have disproportionate carbon dioxide emissions. Energy demand and carbon emissions are closely linked; several of the Government's sustainability indicators include carbon dioxide emissions as a proxy for other changes, for example household energy demand, electricity generation and road transport all include carbon dioxide emissions (DEFRA, 2007a). The carbon footprint study undertaken by the Stockholm Environmental Institute (SEI) reviewed the energy used by each demographic. This clearly showed how the 50+ generations use significantly more energy than the younger generations. In a county such as Cornwall where 48.3% of the population is over the age of 45 (Miller, 2006) the increase in energy demand compared to a younger county may

be significant. The study by the SEI found that the home and energy carbon dioxide emissions were nearly 20% higher than the UK average for the 50-64 demographic, over 35% higher than average for the 65-74 group and more than 40% above the average for the 75+ generation.

4.3. Energy prices

In recent years, energy prices for both the industrial and domestic sectors have risen. The extent to which the prices have risen varies with each fuel type. This has impacts on the economy with the end-consumer often being the hardest hit as the price of goods and services is increased to cover costs. Many areas of the UK enjoy the luxury of domestic energy choice and can choose the most cost effective option. However, in Cornwall where mains gas supply is poor, options are limited and therefore switching domestic energy choice in reaction to price increases is not possible. In the worst case scenario this can lead to fuel poverty (see Section 4.4). The recent increase in fuel prices for both the industrial and domestic sectors can be seen below in Figures 17 and 18 respectively. The fall in price around the 1980s reflects the exploitation of the indigenous fuel supply but the subsequent rise around 2000, marks the point at which the UK became a net importer of energy.

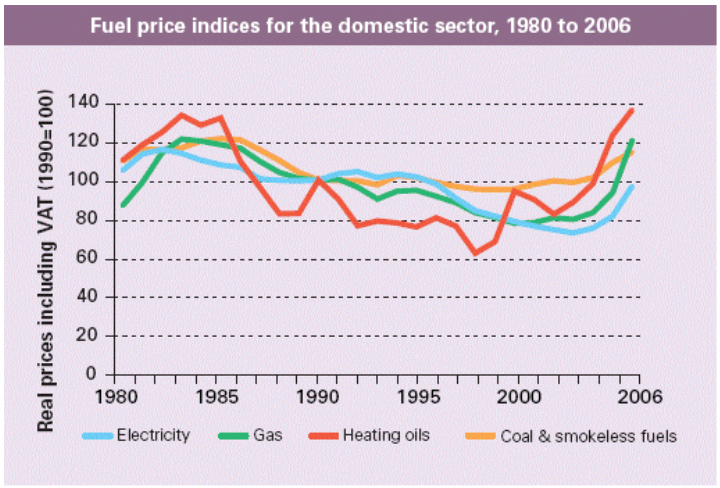
Figure 17 - UK industrial energy prices



Source – (BERR, 2007b – *Reproduced under the terms of the Click-Use license*)

The rise in industrial fuel price is perhaps less significant in Cornwall where services rather than industrial process dominate. However, consumers of nationally produced products are likely to be effected by the rise in costs passed on by the manufacturers.

Figure 18 - UK domestic energy prices



Source – (BERR, 2007b – *Reproduced under the terms of the Click-Use license*)

Rising domestic energy prices can have serious implications for residents where alternative energy is not an option particularly in areas where income is particularly low. Section 4.4.1 discusses the implication of fuel poverty in Cornwall.

4.4. Fuel poverty

The department for transport and industry describes fuel poverty as,

> *"A household is said to be in fuel poverty if it needs to spend more than 10 per cent of its income on fuel to maintain a satisfactory heating regime (usually 21 degrees for the main living area, and 18 degrees for other occupied rooms"* (BERR, 2007c)

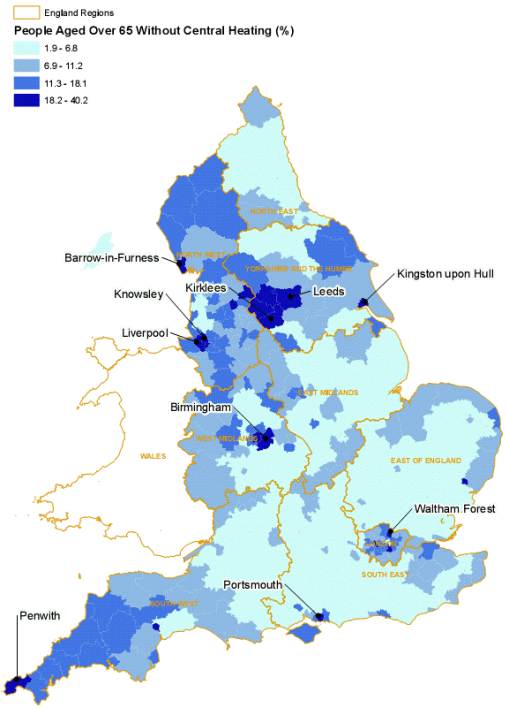
The fall in domestic fuel prices between the 1980s and late 1990s saw the number of households in the UK deemed in fuel poverty decrease. However, given the recent rise in fuel prices and the further forecast increases for the 2008/09 winter, even more people can expect to be in fuel poverty. The indications suggests Britain may face energy shortages and soaring energy prices, as a result of an increase in liquefied natural gas price and the failure to complete a new gas plant in South Wales (Macalister, 2007). This demonstrates the vulnerability of the energy supply in the UK.

4.4.1. Fuel poverty in Cornwall

In a study by the Centre for Sustainable Energy and, Bristol University commissioned by Cornwall County Council in 2001, 22.3% of households in Cornwall were deemed to be in fuel poverty. As a County this falls below the average for England which stands at 24.4%. However, some wards within Cornwall had as much as 38% of properties in fuel poverty (CCC, 2001) (13.6% higher than the national average). The study took place whilst domestic fuel prices were around their lowest so, in line with the national forecast, the number of properties in fuel poverty in Cornwall can be expected to increase.

In a more recent report, the Department of Health (DoH) have identified a similar situation although at a cruder resolution. The DoH has produced a map of England illustrating the percentage of the population aged over 65 and without central heating. All of Cornwall falls into the 11.3 – 18.1% of the over 65s without central heating category with Penwith and the Isles of Scilly in the higher 18.2 – 40.2% category (see Figure 19 below). The Isles of Scilly are ranked tenth on England's "cold spots" at an average of 20.9% of the over 65s without central heating (DoH, 2007a).

Figure 19 - Department of Health produced map of England illustrating the percentage of 65+ years without central heating



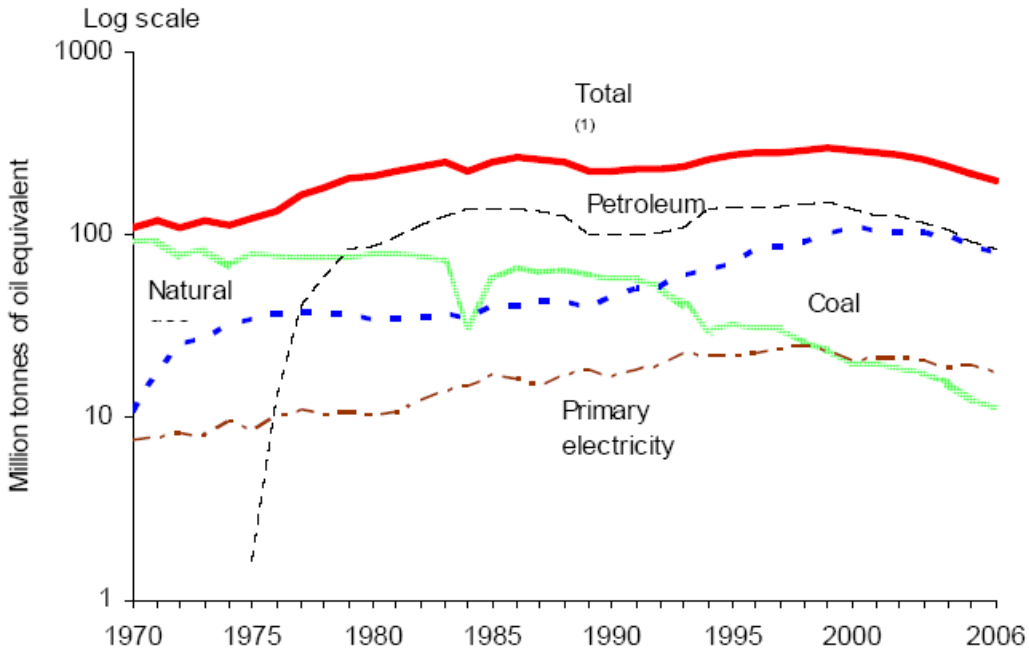
Source - (DoH, 2007b)

The limited fuel supply choice in Cornwall and the Isles of Scilly, caused essentially by the poor gas supply to the county (German, 2006), makes the County particularly sensitive to rises in energy prices. Where some areas have option to change energy supply type, many areas in Cornwall simply cannot. Therefore if energy prices rise, the end user, be they domestic or industrial, has no option but to pay. This, in some domestic situations could lead to fuel poverty and in industrial cases lead to reduced profits and loss of jobs. The recent, sharp, rise in both domestic and industrial fuel prices is likely to result in increased domestic fuel poverty and may precipitate economic decline.

4.5. Energy production - UK

In 2004, following the decrease in energy production in the UK since 1999 (Figure 20), the UK became a net importer of energy. Fossil fuel imports dependency increased to 21.3% in 2006 as energy production in the UK continued to fall (BERR, 2007d).

Figure 20 - UK production of primary fuels 1970 to 2006



(1) Includes renewables waste and heat.

Source - (DTI, 2007a)

Figure 20 taken from the *Digest of United Kingdom Energy Statistics 2007*, clearly shows the decline in production of primary fuels between 2000 and 2006.

4.5.1. Energy production in the South West

The DTI published electricity generation figures for the South West in 2004. The total installed capacity was 3,097 MW with 46.6% derived from fossil fuel plants and the other 53.4% from nuclear power plants. Electricity from the nuclear power plants will cease in stages as the two plants are decommissioned, this will result in 434 MW being lost in 2008 and a further 1,220 MW being lost in 2012 and total of 1,645 MW (Norton, 2006). The Langage Park Gas turbine will be operational in 2009 and will produce 885 MW bringing the total electricity production (not including renewables) in the South West to 2,337 MW in 2012. This will produce 20 TWh of electricity yet in 2005 the South West consumed 27 TWh of electricity, a deficit of 31%.

This demonstrates the vulnerability of the energy supply in the South West and its dependency on importing. There is a real and necessary opportunity for the Cornwall and the South West to make better use of renewable energy to first fill this electricity deficit and then increase the reliance on renewable sources and move away from fossil and nuclear derived supplies.

4.5.2. Renewable Energy

In 2006 around 4% of electricity generated in the UK came from renewable sources (DTI, 2007b). The target for renewable energy published in the Renewables Obligation (2002) is 15% of the energy mix in 2015. Alternative sources of energy need to be identified and the UK has many options including wind, tidal, biofuel and waste incineration. One of the major attractions of renewable energy sources is the lower carbon emissions.

> "*For every 1 GW of fossil fuel fired electricity generation capacity displaced by an equivalent amount of renewable electricity, carbon emissions would be around 0.7 MtC to 1.5 MtC lower*" (BERR, 2007e).

The following section looks at the renewable energy production and opportunities in the South West region including Cornwall and the Isles of Scilly.

4.5.3. Renewable energy production in the South West, Cornwall and IoS

Despite having the most diverse renewable energy resource in the UK, only the North East and London produced less renewable energy than the South West Region in 2005. At present just 2.3% of the South West region's electricity is produced by renewable sources (Norton, 2006). The benefits of renewable energy sources are numerous, particularly in a county such as Cornwall that has no traditional power stations (Langage Park gas turbine power station will be operational in 2009 and will contribute 885 MW of energy to the South West region (Centrica, 2006)), and therefore relies almost entirely on imported energy. Table 5 below, details installed renewable electricity capacity and actual electricity produced in the South West. This highlights the large difference between the potential energy from renewable sources and that which is actually generated by this emerging sector.

Table 5 - Renewable electricity capacity and actual production in the South West

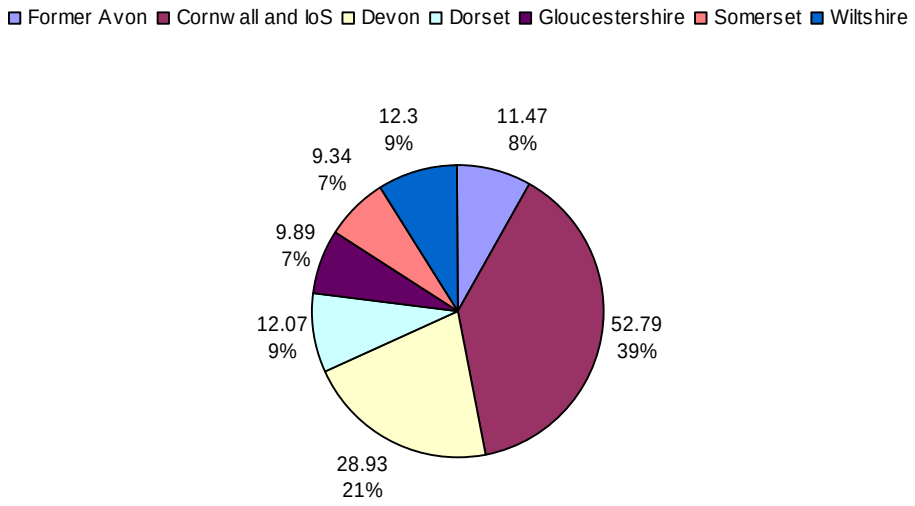
Year	Capacity (MW)	Production (GWh)
2003	114.6	441.4
2004	129	552.8
2005	139.2	625

Source – (BERR, 2007f)

4.5.4. Installed renewable electricity capacity in the South West

The distribution of installed renewable energy capacity in the South West region is not homogenous. In spite of the fact that Cornwall and the Isles of Scilly have just 15% of the land mass and just 16% of the South West's population, Cornwall supplies over a third (39%) of the total renewable energy due largely to the presence of wind farms in North Cornwall and Kerrier (REGENSW, 2007). Figure 21 details the capacity (MW) and regional distribution (%).

Figure 21 - Distribution of installed renewable energy capacity (MW) in the South West

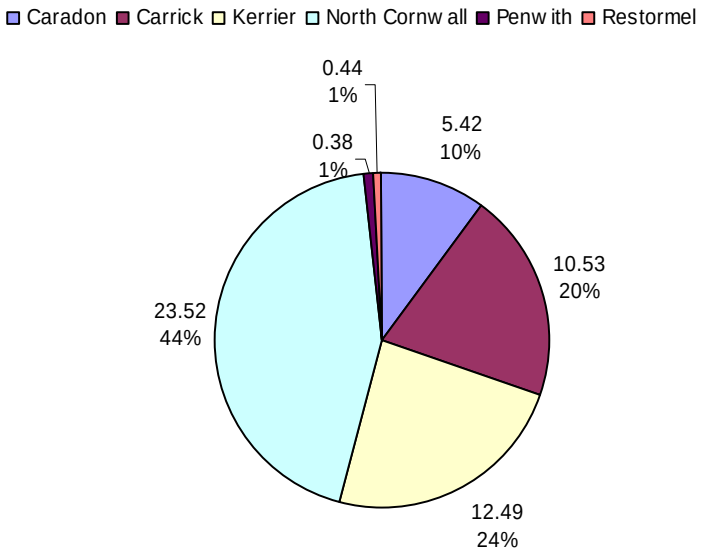


Source – (REGENSW, 2007)

4.5.5. Installed renewable electricity capacity in Cornwall

Figure 22 shows that collectively North Cornwall and Kerrier District provide 68% of the renewable electricity capacity in Cornwall, the result of the installation of large wind farms in both of these Districts.

Figure 22 - Installed renewable electricity capacity (MW) and distribution (%) in Cornwall



Source – (REGENSW, 2007)

The total installed capacity of renewable electricity in Cornwall and the Isles of Scilly is 52.78 MW. This has the potential to generate 462 GWh of electricity. However, as with traditional technology, energy capacity and actual energy generation are different. By using efficiency factors produced by the South West Renewable Energy Agency (REGENSW) the actual electricity generated from renewable sources in Cornwall and the Isles of Scilly is closer to 189 GWh. This equates to 13.4% of the domestic electricity sold in Cornwall and the Isles of Scilly in 2005 (BERR, 2007g).

4.6. Future plans for renewable energy in the South West and Cornwall

If the ambitious targets for renewable energy generation are to be met, there needs to be significant and rapid investment in the coming years. As mentioned previously, the South West has a wealth of resources available to capitalise upon yet the performance is poor. In 2003 the regional renewable energy strategy for the South West of England 2003 – 2010 was produced. The strategy was produced after the Government published its Energy White Paper, with the aim of progressing renewable energy in the South West. To meet the target of 11 – 15% renewable energy by 2010, 545 MW of installed capacity is required (Table 6). In a survey undertaken in 2007 by REGENSW, a group setup following recommendation in the regional strategy, the installed renewable electricity capacity was declared to be 137 MW (REGENSW, 2007). This is just a quarter of the target and strongly suggests the 2010 target will not be achieved. The opportunity (and need) to utilise renewable energy in the South West and Cornwall remains and will be discussed in the following sections.

Table 6 – South West renewable energy strategy plans and technology type.

RENEWABLE ENERGY TECHNOLOGY		REGIONAL TARGET: ASSESSMENT OF NEW RESOURCE POTENTIAL	
		NO OF SCHEMES	CAPACITY (MW)
Offshore wind	(50MW, 20-30 turbines)	1	50
Onshore wind	Medium scale wind farms (25MW, 10-20 turbines)	6	150
	Small wind clusters (6MW, 4-10 turbines)	13	78
	Single large turbines (1.5MW)	15	22.5
	Single small turbines (0.03 MW)	50	2.5
Biomass: combustion of energy crops and/ or agricultural and forestry wastes	Large CHP or electricity (20+ MW, wood, straw and chicken litter)	5	105
	Medium CHP (5MW, wood)	7	35
Biomass: anaerobic digestion	Fuelled by farm biogas (0.5MW)	5	2.5
	Fuelled by sewage gas (0.5MW)	2	1
Municipal or industrial wastes	CHP or electricity (10MW)	2	20
Green waste	CHP or electricity (1-2MW)	6	7.5
Landfill Gas	CHP or electricity (1-2MW)	8	11.2
Small hydro power	(0.1MW)	30	3
Solar photovoltaics (PV)	Domestic & commercial schemes	2,929	12.25
Tidal current	(7.5MW)	3	15.3
Tidal barrage		1	28
Shoreline wave		1	0.5
TOTAL		**149 + PV**	**545**

Source – (REGENSW, 2003)

4.6.1. Future plans for renewable energy in the South West – wind

A report produced in 1996 (O'Rouke) looked at the potential renewable energy that could be produced in Cornwall. Wind energy is the most established source of renewable energy in Cornwall with 74% (39 MW) of the total produced in the County coming from wind farms (REGENSW, 2007). The report investigated mean average winds speed, physical land shape, land designations and existing wind farms and suggested 60 – 70 MW of electricity could, theoretically be produced in the County. Therefore it should be possible to nearly double the current generating capacity of wind farms in Cornwall.

The report included issues regarding the impacts of wind turbines beyond that of the energy generation such as visual intrusion, noise, traffic, ecological and conservation issues all of which must be considered alongside the long-term gains of installing renewable energy technology.

The most recent addition to wind farms in Cornwall is the project at Roskrow Barton, Penryn. The two large turbines (44 m high) began supplying the local electricity distribution network at the end of 2007. The farm will generate an estimated 5,500 MWhr per annum, enough to supply approximately 1,100 homes in Cornwall. The project has been completed by Cornwall Light and Power Ltd, who also aim to upgrade the existing Goonhilly wind farm on the Lizard peninsular from 5.6 MW to 21 MW installed capacity. Depending on the planning process, the Goonhilly upgrade could be operational by 2009 providing an additional 17.1 MW of renewable electricity generation to the existing 5.6 MW generated at the site (CLP, 2007).

4.6.2. *Future plans for renewable energy in the South West – wave*

In the Land Use and Renewable Energy in Cornwall report (1996) the notion of harnessing wave energy was acknowledged but due to the fact that the technology was still very much in its experimental stage no serious opportunities for Cornwall were included. Just over a decade later and Cornwall is about to become home to a significant offshore wave powered renewable energy device known as the "Wave Hub". Like the wind farms in 1991, this is another pioneering exercise for the County which has numerous economic and environmental opportunities. The planned Wave Hub will, according to the South West regional development agency (SWRDA) produce enough electricity for 7,500 homes, generate £560 million in the UK and generate almost 1,000 jobs in the South West (SWRDA, 2007). The production of 30 – 40 MW electricity capacity will be a further contribution to achieving the renewable energy target for the region.

4.6.3. *Future plans for renewable energy in the South West – energy from waste*

The issue of waste management in Cornwall is discussed in detail in Section 6 but the salient thrust of the situation is a lack of landfill capacity and an urgent need for an alternative disposal method. Cornwall County Council has opted for an Energy from Waste incinerator that will not only deal with the problems associated with the closure of landfill sites in the County but will also generate electricity which can be exported to the National Grid. The proposed incinerator will produce 16.6 MW or 145 GWh of electricity, enough to power approximately 15,000 homes with additional, yet very local, supply of heat to local industry (Sita, 2006). The proposed Energy from Waste plant is hoped to be operational by 2011/12 depending on the planning process.

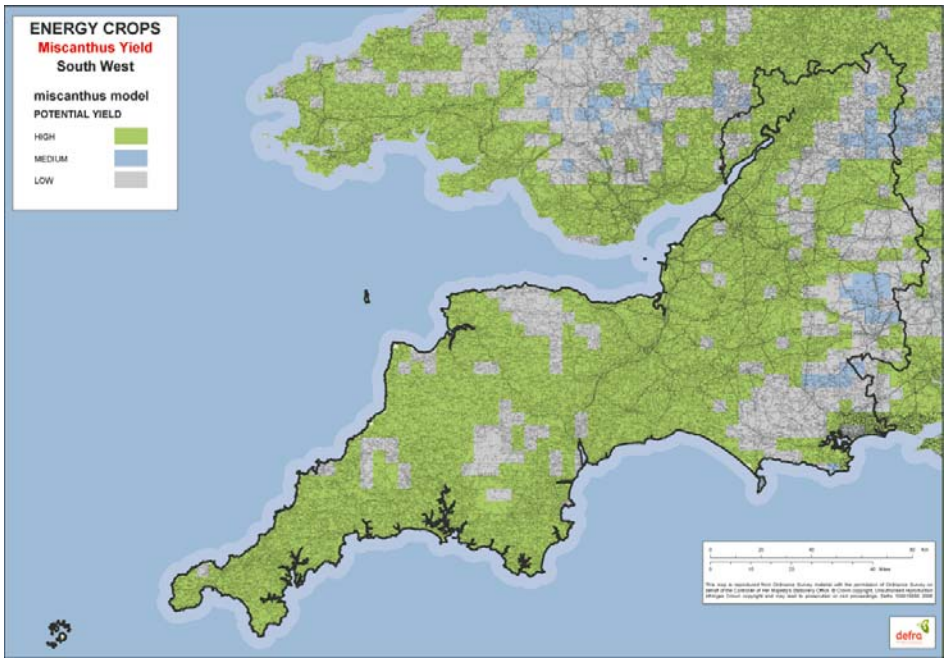
4.6.4. *Future plans for renewable energy in the South West – biogas*

Biogas collectively includes gas from both sewage and from landfill. In Cornwall the renewable energy derived from sewage gas is just 0.8 MW but the energy from landfill gas or LFG is 11.4 MW, 21% of the renewable energy capacity in Cornwall (REGENSW, 2007). This comes from four generation sites, two at each of the landfill sites in Cornwall; United Mines and Connon Bridge. Both of these sites will be shut as landfill sites by 2010 and 2014 respectively effectively ending the life of this renewable energy source.

4.6.5. *Future plans for renewable energy in the South West – energy crops*

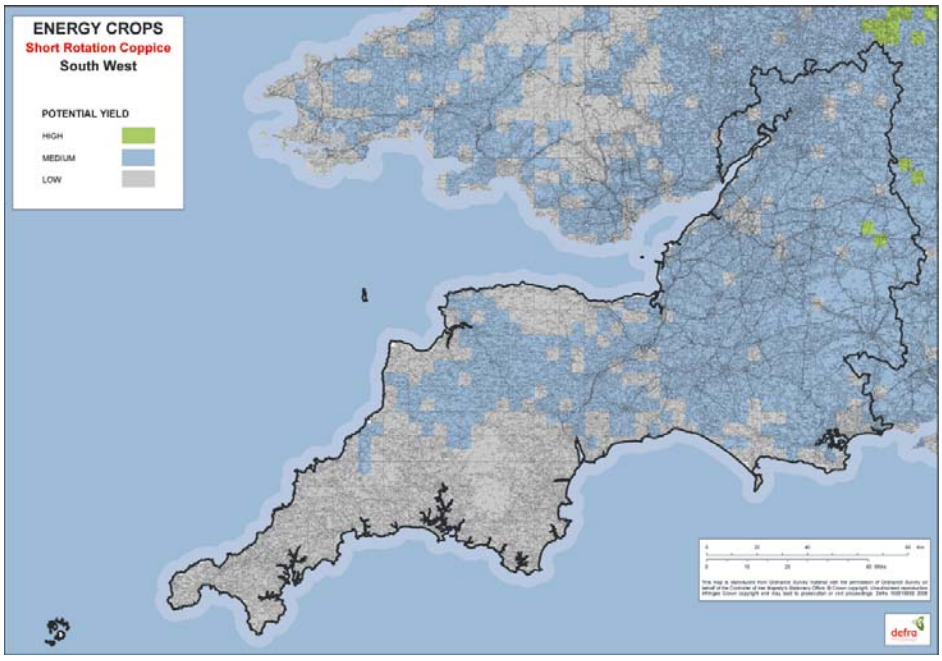
Investigations into the feasibility of growing "energy crops" across the UK including Cornwall and the Isles of Scilly have been undertaken by DEFRA. Models have been used to identify areas suitable for growing *Miscanthus* and Short Rotation Coppice (SRC). Both models have numerous limitations and the maps produced must be used in conjunction with guidance issued by DEFRA (http://www.defra.gov.uk/farm/crops/industrial/energy/opportunities/guidance.htm). The potential impact of climate change on the growth and yield of the crops is not included in the guidance. This could however, have a significant impact on the *Miscanthus* in particular due to its sensitivity to water availability. What the maps do show is that much of Cornwall has a potentially high yield of *Miscanthus* (Figure 23) but the potential yield of SRC is low (Figure 24). DEFRA have also included land designations within their investigations which show how much of the land in Cornwall and the Isles of Scilly is protected and therefore would not be suitable for development as an area for the growth of energy crops. If agricultural land was used for the production of energy crops in Cornwall and the Isles there would obviously be repercussions for the area of land available for the production of food.

Figure 23 - Potential *Miscanthus* yield in the South West



Source – DEFRA, 2007e

Figure 24 - Potential Short Rotation Coppice yield in the South West



Source – DEFRA, 2007e

4.6.6. Future plans for renewable energy in the South West – other schemes

The methods and technologies for generating renewable electricity listed in this Section do not encompass all renewable electricity generation methods but represent the larger scale operations that exist in the County at present. There are an increasing number of domestic renewable energy systems available including turbines, solar panels and ground source heat pumps. Many of these systems are at present, expensive to purchase and install creating a long pay-back time. There are also issues regarding planning permission and the installation of some of

these devices. Until the technology is improved and the pay-back time reduced, uptake of domestic renewable energy systems will be relatively slow.

A cheaper, more cost effective method for domestic energy saving is to improve the property insulation and install energy efficient appliances. Despite the often higher high-street cost of A-rated energy appliances compared to lesser performing appliances, the energy and therefore financial savings of the A-rated appliances will quickly negate the initial higher capital costs.

"It is cheaper to improve energy efficiency than it is to build new generation capacity to compensate for waste; greater efficiency also reduces the environmental impact of economic growth." (EBRD, 2006)

4.7. Energy – summary

The energy supply to the South West is not sustainable. It currently relies on nuclear technology and fossil fuels as well as importing energy to meet the demand. The region is incredibly fortunate to have a wealth of renewable energy resources available yet at present it is not capitalising on them. There is some action occurring but it is too slow. There needs to be significant investment in the technology and infrastructure to prepare the region and the individual counties for the necessary shift to alternative energy sources to survive in the culture that has been created. There also needs to be effort from the users to improve efficiency and therefore reduce demand.

- Wards in Cornwall have been identified as having some highest percentage of population in fuel poverty, rising fuel prices may increase the problem.
- Limited fuel supply choice leaves many in the County without the option of choosing an energy source with fewer carbon emissions.
- Cornwall's carbon dioxide emissions per capita are higher, in part as a result of its demographic profile.
- Domestic renewable energy systems are often expensive for individual households and have a long pay-back period which is unattractive for potential investors.
- Renewable energy production in Cornwall is growing but is not utilising the full potential.

5. FOOD

In a report produced by Huxley (2006) the environmental impacts of food production and consumption were discussed. The report included the concept of "food miles" which has generated significant attention in recent years. The ideal scenario for many is for food to be produced for a very local demand. This situation, which is similar to that of the early 1900s, would reduce the distance the food is transported and therefore reduce the associated emissions. The idea should also reduce the time from ground-to-plate which improves the nutritional content of the food; an idea promoted as "Slow food" (Slow food, 2007) and support for local economies is implicit.

The report by Huxley (2006) includes figures which show how far removed from this situation the UK now is. Food haulage accounts for 25% of all HGV (Heavy Goods Vehicles) transport in the UK. Air freight, which is the fastest growing method of food transportation, produces "*11% of the CO_2 equivalent emissions from 1% of all UK food volume transported*".

The Soil Association has reacted to the increased UK consumer demand for organic produce being met from abroad and began consultation in June 2007 regarding whether or not food that has been transported to the UK via air freight can display their organic food label. Several options have been proposed and consultation was open until September 2007 (Soil Association, 2007). This is an early indication that food transported in this way may not be socially acceptable to a growing number who understand and are concerned about the way in which it is supplied.

Some researchers have begun looking at the emissions associated with the production of food before it even begins transportation to the final outlet. Research specific to the production of beef has found emissions with a global warming potential equivalent to 36.4 kg of carbon dioxide released per kilogram of beef produced (Guardian, 2007). The research does not include the transport emissions after the production of the meat which will increase the total emissions further depending on the distance and method by which the product is transported.

Huxley (2006) also raises issues regarding food security and the possible impacts of sea level rise and a changing climate. The wet weather experienced during summer 2007 brought difficulty to many farmers across the country with reports of crop losses and difficult harvesting. In response to the summer floods, Richard Hazlet, the National Farmers Union East-Midlands regional director said,

> "*…farmers will now be thinking about how they can adapt and change their farming practises and businesses to the changing climatic conditions*" (NFU, 2007a).

Although it is hard to fully calculate the extent of the financial losses to the farming community; losses due to the floods were forecast to be "heavy" (NFU, 2007a). In August 2007, high street food prices were up 2.7% on the previous year (Surman, 2007) largely due to the knock-on effects of the summer floods. This is perhaps an early indicator of the type of food price rises consumers can expect as a consequence of climatic changes impacts on agriculture.

This Section looks at the issues highlighted in the introduction specific to Cornwall and the Isles of Scilly and what the possible repercussions may be. The problem of identifying data is immediately apparent making what is a crucial issue, an uncertain quantity.

5.1. Food production in the South West

Accessible food production data at county or district resolution are scarce or non-existent. Food production, import and export data for the South West region are available for 2001 in a report published in 2005 (Stepping Forward). The Gross* supply of food in the South West in 2001 amounted to 8,345 ktonnes. Of this, 4,603 ktonnes of food was available for domestic consumption whilst the net food consumption was 3,445 ktonnes (Table 7) (Stepping Forward, 2005).

Table 7 - Food production data for the South West region in 2001

	Quantity (000s tonnes)
Production	6921
Imports	2354
Exports	1026
Stock changes	96
*Gross supply	8345

Source - (Stepping Forward, 2005)
*Gross supply includes all raw food supplied to the South West prior to processing.

5.2. Food consumption in the South West and Cornwall and the Isles of Scilly

Food production within a region will not meet the exact demands of the industrial and domestic consumers. As a result importing and exporting takes place. In 2001 the gross supply of food in the South West was 8,345,000 tonnes which was split between non-domestic and domestic usage, 3,741,000 tonnes and 4,603,000 respectively. The majority of non-domestic use was committed to livestock feed (2,368,000 tonnes) whilst the net domestic consumption was 3,445,000 (Stepping Forward, 2005). This equates to 698 kg per capita which using population data for Cornwall and the Isles of Scilly can be used to estimate consumption figures for the County in 2001. This figure is 350,466 tonnes, a little over 10% of the South West region's consumption.

5.2.1. Food consumption in Cornwall and the Isles of Scilly – forecast per capita demand

Using the consumption per capita figures in Section 5.2 (698 kg) and population growth figures in Section *12.1.2*, it is possible to calculate the approximate increase in food consumption in Cornwall and the Isles of Scilly over the next decade. If the population reaches the forecast 596,000 in 2021 and assuming consumption per capita remains at 698 kg, the total for Cornwall and Isles of Scilly will be 416,008 tonnes, approximately 65,500 tonnes greater than the figure calculated for 2001. This will place a higher demand on the yield from land in Cornwall and the rest of the country which given the possible risks associated with climate change, might not be feasible. There will then be a greater need to utilise "spare" land available for agriculture as well as increasing imports from abroad which will come with the associated carbon foot print (Section 5.5.1). There will also be a need to develop and implement more productive technologies and crops to get more out of the land.

5.3. Food consumption – the impact of tourism

In Cornwall and the Isles of Scilly, the effects of fluctuating demand on food supply caused by the flux of tourist numbers will undoubtedly have ramifications. Demand will come directly from the consumer i.e. tourists purchasing individual food items at supermarkets etc, as well as a rise in demand from food outlets, restaurants and campsites etc. The rapid rise and fall in demand has to be forecast to ensure sufficient supply but also to prevent waste which could result from over supply.

The extent of the demand has not been quantified (by mass) making it difficult to understand the food consumption behaviour of tourists. Research undertaken by South West Tourism has calculated the fiscal expenditure on food and drink by tourists in Cornwall to be £400 million per annum (South West Tourism, 2005).

The difficulty of collecting and then separating food consumption data for residents and tourists in Cornwall and the Isles of Scilly is profound but accurate data would enable a better understanding of the impact of tourism on the environment in the County. For example, is the majority of food purchased by tourists from local farm shops or outlets which rely in imports from beyond the County and even the country? The difference in terms of environmental, economic and social impact would be significant but at present that information is not known.

5.4. Food purchased in the South West

As with food production in the South West, county specific data for food purchased are not available. However, food purchasing trends in the South West can be indicative of patterns in Cornwall and the Isles of Scilly. The trend of food purchased fluctuates between each year and each product. However, the overall trend is a slight increase in per capita purchasing between 2001/02 and 2005/06 (DEFRA, 2007f).

5.5. Food production and the environmental impact

The environmental impact associated with food production and transport is rapidly gaining a higher profile and being looked at as another possible source for emissions reduction. There are also economic and health benefits associated which will be discussed in the following Sections.

5.5.1. Food miles

The concept of food miles is a basic idea which looks at the emissions resulting from the total miles food is transported between its production and consumption; the fewer miles food travels the fewer emissions and therefore the smaller the impact on the environment. Calculating food miles with any degree of accuracy is dependent on the availability of accurate data which however, is not available.

Research is now suggesting that the energy associated with the overall production of food is more important than food miles alone. Evidence indicates that despite the food miles associated with import transport, the overall energy and carbon dioxide emissions can be lower than that associated with food produced in the UK. This is due to the methods of production in the UK, which as reported by Saunders *et al.* (2006) of many imported foods, is particularly energy intense. One of the examples in the report includes the production of dairy products (as milk solids (MS)). Table 8 below shows the total carbon dioxide emissions per tonne from both the New Zealand and the UK product. This total includes the food miles from New Zealand to the UK yet the New Zealand produce still produces less than half the total carbon dioxide emissions.

Table 8 - Comparison of emissions from dairy production (Milk Solids (MS)) in the UK and New Zealand

	CO_2 Emissions CO_2 kg / Tonne MS	
	New Zealand	UK
Total production emissions	1,422.5	2,920.7

Source – (Saunders *et al.* 2006)

This demonstrates that these issues are complex. Some agricultural practices are very energy intense and some crops are grown on land that is not optimal for the choice of produce. There are opportunities for the agricultural industry in the UK and Cornwall to improve farming practices and reduce emissions associated with product production.

Another and perhaps more fundamental argument would be to question our continuing ability to import some food items. A report produced by the Cabinet Office (2008) detailed the environmental costs associated with the UK food chain. Importing food to the UK produced 21 Mt CO_2 equivalent greenhouse gas emissions, 16% of the emissions from the UK food chain.

5.5.2. Food production and the impact of climate change

The weather conditions of recent years appear to be making the UK agricultural industry increasingly prone to loss. Significant losses in crop yield have reduced the supply of some crops, increased prices, and have increased dependency on imports. Such is the concern about the impact of extreme weather events that DEFRA have commissioned a study of the "Vulnerability of UK Agriculture to Extreme Events" (http://www.rothamsted.bbsrc.ac.uk/bab/mas-projects/Extreme/index.html). As mentioned elsewhere in this report, the detailed impact of climate change is difficult to predict and therefore the associated weather events are even harder to foresee. The IPCC have forecast an increase in frequency of extreme weather is "*very likely (>90%)*". (IPCC, 2007).

In July 2006 the UK experienced record breaking temperature highs which brought exceptional fruit crops and what appeared to be the potential for a new market. Contrary to this, the summer of 2007 saw record breaking rainfall and tonnes of crops were ruined and lost. The lost crops resulted in a 2.1% increase in food prices on the high-street in August 2007 (Surman, 2007)

The evidence of recent years shows the agricultural industry must respond with foresight to issues around crop choice, planting locations and timing to not only minimise losses but to also take advantage of new opportunities.

5.5.3. Food production and land use pressures

The demand for food production is likely to change the shape and character of the countryside. If land use can be altered to increase profit then the agricultural industry will make that change. Such changes may, alter habitat and there is concern various government grant schemes (e.g. the Environmental Stewardship (formerly the

Countryside Stewardship)) will no longer be financially attractive and the land will be used for the production of food.

5.6. Cornwall food programme

The Cornwall Food Programme is a scheme being run by the NHS in Cornwall which has support from the five Primary Care Trusts in the County. The Programme is driven primarily by the economic gains for the County brought about by supporting the local economy, offering longer contracts and encouraging money to be spent locally by both the Trusts and the staff as well as by the health benefits. The commitment to supporting local growers, suppliers and producers has additional benefits to the economy. By providing food sourced locally the period from harvest to consumption should be reduced and therefore the nutritional content of the food should be higher. This is advantageous for the patients of the NHS Trusts and their quality of life and well being whilst in hospital. The environmental benefits also include reduced food miles (see Section 5.5.1) associated with sourcing local produce.

If more schemes such as the Cornwall Food Programme were adopted, the Cornish food industry could work towards a more sustainable future with the added bonus of improved patient heath care and reduced environmental impact.

5.7. Food – summary

- A lack of Cornwall specific data on production and consumption makes calculating the exact demands of the County difficult.
- Lack of tourist related food consumption makes identifying tourist impact difficult.
- Demand to produce bio fuel may conflict with increasing demand for food production.
- Climate change and extreme weather events may continue to increase food production costs. Changes in climate may also offer new crop opportunities.
- Rising fuel prices will continue to increase food production costs.
- Localising food supply has been demonstrated by the NHS in Cornwall. More and larger schemes like this should be investigated in Cornwall.

6. WASTE

The problem of waste and waste disposal is not unique to Cornwall and the Isles of Scilly. In 2006/07 England produced 29.1 million tonnes of municipal waste, 16.9 million tonnes (58%) of which was sent to landfill (DEFRA, 2007g). Many landfill sites are reaching their capacity and despite increased rates of recycling and composting, waste production has been increasing annually by an average of 0.5% in the period between 2000/01 and 2006/07 (DEFRA, 2007g). The situation is improving following the introduction of the Waste Strategy for England 2007. Composting and recycling figures have nearly quadrupled since 1996/97, now 27% (2005/06) with recycling of packaging increasing from 27% to 56% between 1998 and 2006 (DEFRA, 2007g). The Government has set several targets in its "Waste Strategy for England 2007" to address the issue of waste which includes;

- decouple waste growth (in all sectors) from economic growth and put more emphasis on waste prevention and re-use;
- meet and exceed the Landfill Directive diversion targets for biodegradable municipal waste in 2010, 2013 and 2020;
- increase diversion from landfill of non-municipal waste and secure better integration of treatment for municipal and non-municipal waste;
- secure the investment in infrastructure needed to divert waste from landfill and for the management of hazardous waste; and
- get the most environmental benefit from that investment, through increased recycling of resources and recovery of energy from residual waste using a mix of technologies.

Source – DEFRA, 2007h

6.1. Waste – performance indicators

To monitor the changes in waste performance the Government includes three indicators in its Sustainability Development Indicators Document (DEFRA, 2007a). These are;

- Waste arising by sector 1998/99 to 2002/03 (indicator number 18a)
- Waste arising by disposal 1998/99 to 2002/03 (indicator number 18b)
- Household waste per person, (a) arising (b) recycled or composted, 1991/92 to 2005/06.

Source – DEFRA, 2007a.

There are also three National Performance Indicators that are specific to waste which Local Authorities will be measured against. These are;

- NI 191 Residual household waste per head
- NI 192 Household waste recycled and composted
- NI 193 Municipal waste land filled

Source - (DCLG, 2007).

These indicators are used nationally, regionally, by county and even at district level. The performance of Cornwall and the Isles of Scilly is looked at in more detail in the following sections.

At present each person in the UK produces approximately half a tonne of waste per year (DEFRA, 2007a). The amount of waste not recycled or composted is at its lowest since estimates began in 1983/84.

6.2. Waste - Cornwall and the Isles of Scilly

Cornwall faces a similar situation with waste as it does with water resources (Section 3). The resident population is increasing, waste generation is increasing and there is the annual burden of the waste generated by approximately 4 million tourists. Unfortunately data for waste generated in Cornwall and the Isles of Scilly is not easily separated into the resident and tourist fractions (Section 6.5 below). It is suggested this has an impact on the Best Value Performance Indicator 84a (Number of kilograms of household waste collected per head of the population) for Cornwall e.g. if waste collected from holiday accommodation is included in the "Total household waste", the waste per person figures will be higher, skewed by the tourist waste. In addition to the problem of increasing waste volume, Cornwall has to deal with the imminent closure of its major landfill sites and the implementation of a new disposal method as well as the growing pressure from Government to increase the volume waste that is either recycled or composted. Starting with the closure of landfill sites, these issues are discussed below.

Although the Government's aspirations are admirable, the increased taxes may "tip the balance" financially, which unless guidance is provided, will leave some companies in difficulty and may result in job losses.

6.3. Waste production - Cornwall

Waste is derived from a variety of sources including municipal, commercial, industrial, agriculture, mining & quarrying, construction & demolition, sewerage and dredged materials. Given the focus on the National Indicators (see Section 6.1) this report will concentrate on the production and management of municipal waste in Cornwall.

Data for industrial and commercial waste is not reported annually with the latest available figures being 2002/03. As with other data sets with limited history, this makes identifying temporal change impossible. The latest available data indicated, this sector was responsible for over half the total waste arising yet we know nothing

about the current impact on the environment. This is not an issue isolated to Cornwall and the Isles of Scilly but a national issue.

Table 9 includes the municipal waste data for 2006/07 and the commercial and industrial waste data from 2002/03.

Table 9 – Municipal waste production in Cornwall

Sector	Quantity (tonnes)	Year	Data source
Total Municipal (including household)	322,761	2005/06	(DEFRA, 2007g)
	327,000	2006/07	
Total household waste	303,465	2005/06	
	298,540	2006/07	

Table 9 shows the quantity of municipal waste (including household) increased by 4,239 tonnes (1.3%). However, the contribution from household generated waste reduced by 4,295 tonnes (1.6%). The reduced contribution is due to a large degree to the increased rate of household recycling. An additional 5,494 tonnes of household waste was sent for recycling in 2006/07 than in 2005/06 (DEFRA, 2007g).

6.3.1. Isles of Scilly

In 2006/07 the Isles of Scilly produced a total of 3,790 tonnes of municipal waste. 3,038 tonnes were incinerated (without energy generation) and 754 tonnes were recycled/composted (DEFRA, 2007g).

6.3.2. Cornwall – Household waste per capita

Household waste per capita in Cornwall reduced by 1.7% between 2005/06 and 2006/07 (Table 10 below). This correlates with the increased rates of household recycling in the County during the same period. This trend must continue to minimise the impact of waste and reduce the burden on waste disposal facilities.

Table 10 - Household waste per capita

	Quantity (Kg)	Year	Data source
Household waste per capita	587	2005/06	DEFRA, 2007g
	577	2006/07	

6.4. Waste disposal in Cornwall

6.4.1. Landfill

After recycling, composting and recovery have been accounted for a total of 231,477 tonnes of waste is sent to landfill in Cornwall per annum (DEFRA, 2007g)

6.4.2. Landfill timeline

There are two major landfill sites in Cornwall, Connon Bridge (Liskeard) and United Mines (Redruth). Both of these sites are due to close within the next ten-years creating urgency for the creation of alternative waste disposal methods in Cornwall. Figure 25 below shows the position and the closing date of the landfill sites. There are no landfill sites on the Isles of Scilly; all waste is incinerated at Porthmellon (CIoS, 2007).

Figure 25 - Major landfill sites in Cornwall and the closing dates

6.4.3. Landfill tax

Cornwall County Council Waste Disposal Authority (WDA) has a strong incentive and interest in the reduction of municipal waste being sent to landfill to not only gain financial rewards but to also avoid increasing landfill tax costs. In a national bid to reduce the volume of municipal waste sent to landfill the Government has been increasing the price of landfill tax by £3/tonne per year since 2002. The price in 2007 was £24 per tonne. In the 2007 Budget announcements, it was stated that landfill tax will be raised by £8 per year between 2008 and 2011, an overall increase of £24 per tonne for the period. If the waste minimisation targets are not met, the tax may well be passed onto residents and businesses alike. The example below taken from the Government's Waste Strategy for England 2007 paper, demonstrates the significance of the price rise.

For example, assuming waste management companies pass on all the tax increase to waste producers, then for a company landfilling all its waste, the cost per tonne of disposal would increase by £24 per tonne by 2010/11 compared with current tax levels. By contrast if the company sent most of its waste to be recycled, with only 25% residual waste landfilled, it would only face an increase in waste treatment costs of £6 per tonne (all other factors remaining equal). For many companies this relative change in costs could tip the balance between recycling and landfill disposal, making recycling now the most cost effective option.

Source - DEFRA, 2007h

6.4.4. Waste disposal - recycling, composting and recovery

Not all waste produced is sent to landfill. Some is recycled or composted whilst some is suitable for recovery. Table 11 lists the recycling, composting and recovery rates from households in Cornwall.

Table 11 - Recycling, composting and recovery rates from households

	Household recycling	Year
Household	86,068	2005/06
	91,562	2006/07

Source - (DEFRA, 2007g)

6.4.5. Waste disposal - recycling, composting and recovery – successes in Cornwall

In 2003 Cornwall achieved its "stretch" target of 20% recycling and composting which was set as part of the County Council's agreement with the Government to deliver the Local Public Service Agreement. The result of this success was not only diverting waste away from landfill but also the County Council and the Districts receiving a £780,000 reward (Owens, 2007). In 2005/06 the County reached 28.5% recycling/composting which is in excess of the Government's target of 25% for Local Authorities in England. Cornwall County Council will be aiming to meet further targets and gain further rewards under the new Local Area Agreement scheme.

6.5. Tourist generated waste

One of the major burdens associated with the Cornish tourist industry is the waste generated by the 4 million visitors to the County each year puts additional demand on the waste disposal services. It ultimately fills up landfill (the main form of waste disposal in Cornwall) faster. Due to the way in which waste is disposed of and dealt with, accurately identifying resident and tourist produced waste is not possible. However, Cornwall County Council waste management department have estimated the annual average contribution from tourism is approximately 32,000 tonnes of which 24,300 tonnes enter the waste stream as household waste (8% of the total household waste in Cornwall) (P. Martin, *Pers comm.*).

6.6. Waste – future plans in Cornwall

In 2006 Cornwall County Council (CCC) awarded Sita Suez the contract to work in partnership with CCC to deliver a sustainable integrated waste management solution for Cornwall. There are numerous plans to improve the waste disposal infrastructure in Cornwall which will help the County meet with the Government's targets set out in the Waste Management Strategy 2007. Plans, which are integral to the Integrated Waste Management (IWM) Contract, include better access to recycling and composting facilities as well as the introduction of an Energy from Waste incinerator which will deal with the forecast volume of waste (240,000 tonnes annually) over the next 30 years (IWM contract lifespan) that is not re-used or recycled/composted.

6.6.1. Waste – future plans in Cornwall – energy from waste

If even the most ambitious recycling targets are achieved in Cornwall there will always be a quantity of waste that cannot be recycled, composted or recovered. In 2014 when the two major landfill sites (Connon Bridge and United Mines) will be at capacity, an alternative waste disposal method must be implemented. Sita Suez and CCC propose to install an Energy from Waste (EfW) incinerator near St Dennis that will deal with the forecast waste production. The EfW incinerator has a capacity of 240,000 tonnes of waste per year (approximately 70% of the municipal waste generated per year) and will generate 132,000 MWh of electricity per year. The EfW plant will deal with municipal waste from Cornwall only and the electricity generated will provide power for approximately 15,000 homes. Bottom ash from the plant will be sold as road aggregate and heat generated by the plant will be used by neighbouring users (Sita, 2006).

6.6.2. *Waste future plans – targets in Cornwall*

The County Council Waste Disposal Authority (WDA) has set targets for the volume of waste sent to landfill (Table 12). If these targets are to be met and fiscal rewards earned (if the Government set targets are met) there needs to be further increases in recycling/composting. The responsibility for achieving these targets will fall to Sita, winners of the Integrated Waste Management Contract.

> *"The contract will require the appointed contractor to achieve a minimum of 50% recycling/composting from all the civic amenity sites, the provision of recycling/composting facilities required by Waste Collection Authorities and the diversion of waste from landfill to achieve Landfill Directive targets"* (Owens, 2007).

Table 12 - Targets for volume of municipal waste sent to landfill

	Target 2006/07	Target 2007/08	Target 2008/09
Original target	218,000	221,000	223,500
Stretch* target	201,650	202,215	201,150

Source – (Owens, 2007)
*Stretch target – more challenging and difficult to achieve but of greater benefit and with financial reward.

The success of the proposed targets will be largely due to public participation following campaigns by the WDA and the newly appointed Sita. If however, public participation is not forthcoming "financial incentives" may be introduced. Pilot "pay as you throw" charging schemes are being proposed in England. Although controversial, it is hoped these schemes will provide the incentive required to encourage recycling rates to meet national targets for landfill reduction in England. The Government's Waste Strategy 2007 allows Local Authorities to charge residents for the volume of waste they dispose of as opposed to recycle/compost (DEFRA, 2007h). The Chartered Institution of Wastes Management said the "pay as you throw" plans might be, *"too little too late"* (CIWM, 2008).

6.7. Waste – limitations summary

- The imminent closure of Cornwall's two major landfill sites requires an alternative disposal method to be implemented before 2010 (closure of the first landfill site).
- The forecast growth in population will increase the volume of waste produced in the County.
- Continued increases in recycling and composting will help reduce waste sent to landfill.
- Accurate tourist specific waste generation data will identify the contribution to the County's total waste production.
- Financial incentives (i.e. tax) could be pushed onto residents and businesses resulting in economic losses.
- Local Authorities pay £24 per tonne of municipal waste sent to landfill. In 2011 this tax will be £48 per tonne.

7. TRANSPORT AND TRAFFIC

Transport is required for business, commuting, accessing and delivering services and pleasure. The transport network around Cornwall is dominated by private motor vehicles. The rail network is limited with large areas of the County not served and the rural, isolated nature of the towns, villages and hamlets make a regular, efficient, cost effective bus service difficult to implement. More than half the population of Cornwall travel to work in a private vehicle. This puts significant pressure on a road network which in many places suffers congestion during the rush hour. A growth in population and economy, and the associated transport demands could have numerous impacts on the environment, the economy, and social well-being in the County.

In recent years transport has been the focus of much attention within the carbon emissions and climate change arguments. As discussed in more detail in Section 2.5 carbon dioxide emissions from transport in the UK contribute to around a third of the total UK carbon dioxide emissions. To minimise and reduce the impact of transport in the environment, changes in technology need to happen to make better use of the resources available to us.

Section 7 will look in detail at the historic and forecast growth of transport and traffic in Cornwall and some of the associated impacts.

7.1. Road transport infrastructure in Cornwall

In terms of road classification, Cornwall has a similar structure to the national breakdown (see Table 13 below). There are no motorways in Cornwall and 90% of the roads are classified as minor. Of the total 7485 km of road in Cornwall 47% falls into the unclassified category.

Table 13 - Road classification and length in Cornwall and Great Britain in 2006

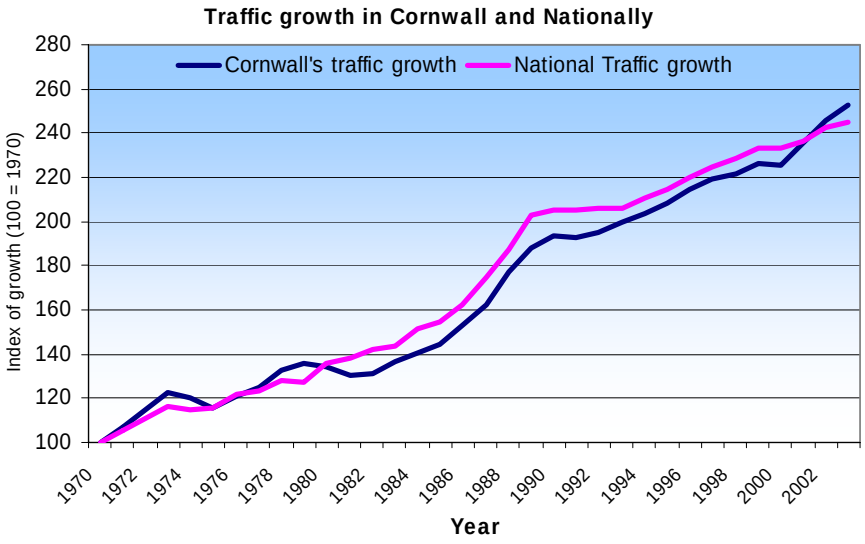
	Cornwall		Great Britain	
Road classification	Km	%	Km	%
Motorway	0	0	3600	1
A-road (Trunk)	186	2.5	8700	2.2
A-road (principle)	555	7.4	38000	9.5
Minor	6744	90.1	348000	87.4
Total	7485		398300	

Source - (CCC, 2006a), (DfT, 2006)

7.2. Traffic growth in the UK and Cornwall

Between 1980 and 2006 traffic growth in the UK rose by 84% and now more than 511 billion vehicle kilometres are driven in the UK every year. During the same period the number of vehicles licensed has increased by 74%, a figure that is dominated by private and light goods vehicles (DfT, 2007). Traffic growth in Cornwall has been very similar to the national trend (Figure 26).

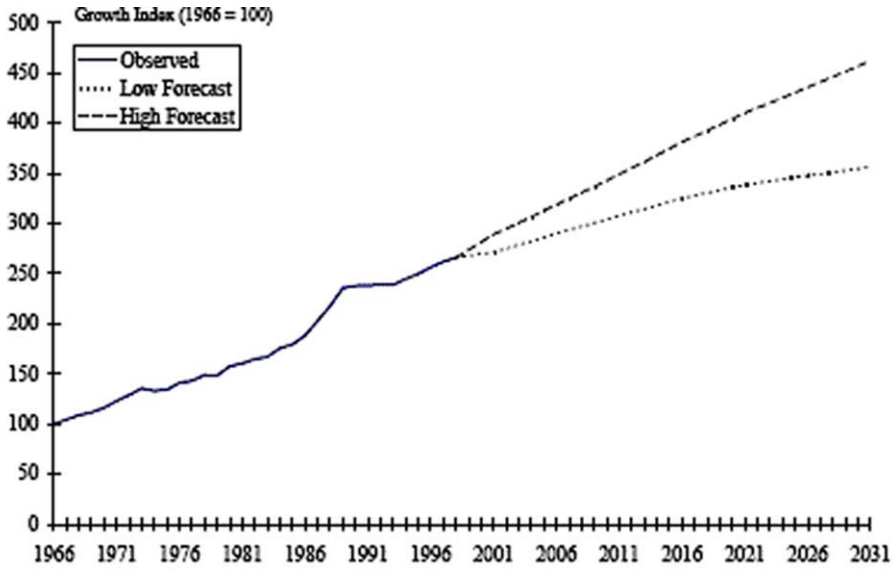
Figure 26 - Traffic growth in the UK and Cornwall between 1970 and 2004



Source – (CCC, 2007a)

The forecast growth in traffic in Cornwall between 1996 and 2031 is 0.95% (low estimate) and 1.8% (high estimate) per annum. Figure 27 below plots the observed traffic growth between 1966 and 1996 and, forecast growth (high and low estimates) between 1996 and 2031.

Figure 27 - Traffic growth index between 1966 and 2031 in Cornwall and the UK



Source – (CCC, 2007a)

7.3. Vehicle registration in Cornwall

Table 14 details the number of vehicles registered in Cornwall between 1995 and 2005. There has been a 43% increase in total vehicles registered in the County. That is an additional 99000 vehicles in the 10-year period.

Table 14 - Vehicle registration in Cornwall between 1995 and 2005

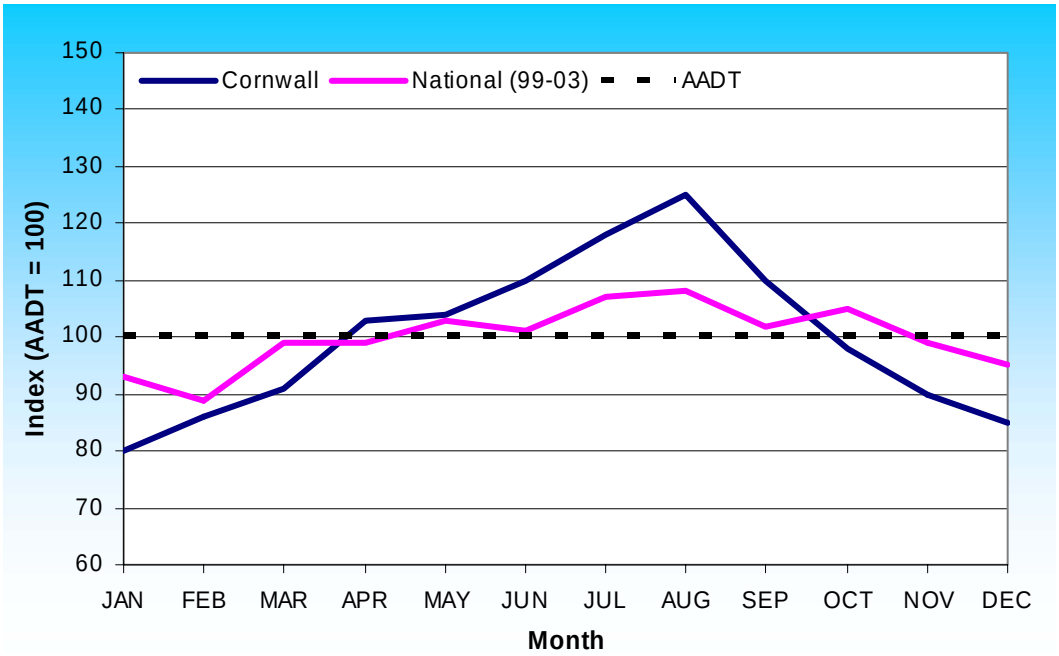
Vehicle category	Motorcycles	Cars & light goods vehicles	Public Service Vehicles	Other Vehicles	Total
Growth (%)	+71	+42	-16	+36	+43

Source (CCC, 2006a)

7.4. Annual average daily traffic (AADT) – seasonal variation

As mentioned elsewhere in this report the population in Cornwall varies significantly during the year as a result of tourism. This has an impact on the transport infrastructure in Cornwall and can cause congestion. This has numerous impacts on the local environment, the economy and social well-being as congestion increases journey times, reduces air quality, increases noise and increases costs to haulage companies transporting goods into and out of the County (Section 7.10). Figure 28 below compares the annual average daily traffic over 12-months in Cornwall with the national average. This clearly shows the significant increase during the summer months whereas the national average remains fairly constant in comparison.

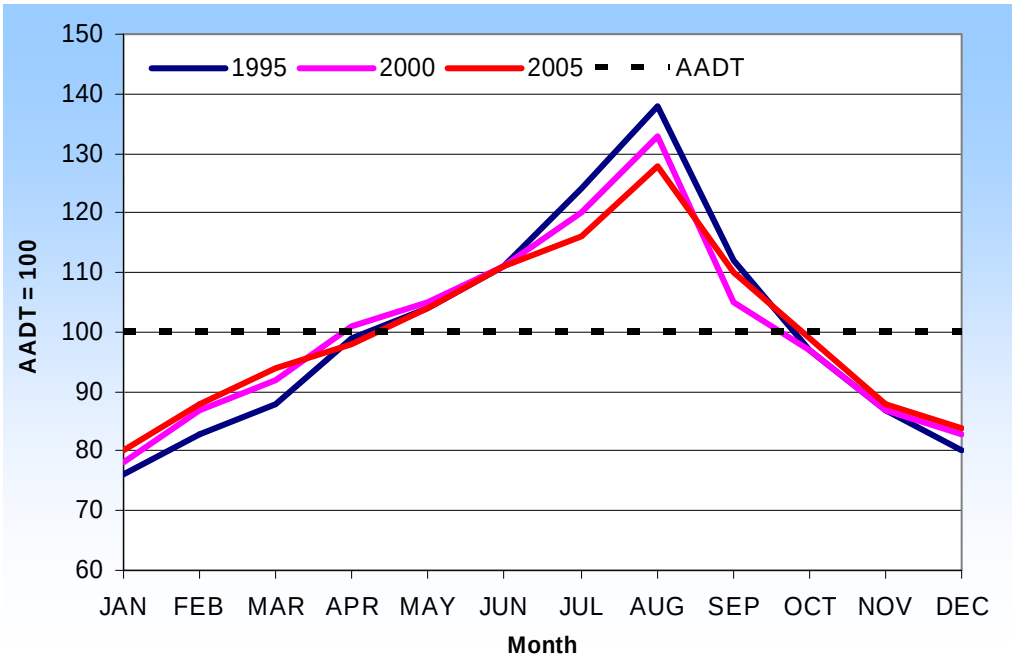
Figure 28 - Annual average daily traffic in the UK and Cornwall



Source (CCC, 2006b)

Although large differences in AADT (Annual Average daily Traffic) exist in Cornwall, the difference has declined in recent years. Figure 29 below shows the gradual reduction of the peak AADT between 1995 and 2005 but it also shows the higher daily traffic in the "shoulder" months e.g. March and October. This is a sign of the extending tourist season and the increasing number of resident population vehicles.

Figure 29 - Annual Average Daily Traffic (AADT) on Cornwall in 1995, 2000 and 2005

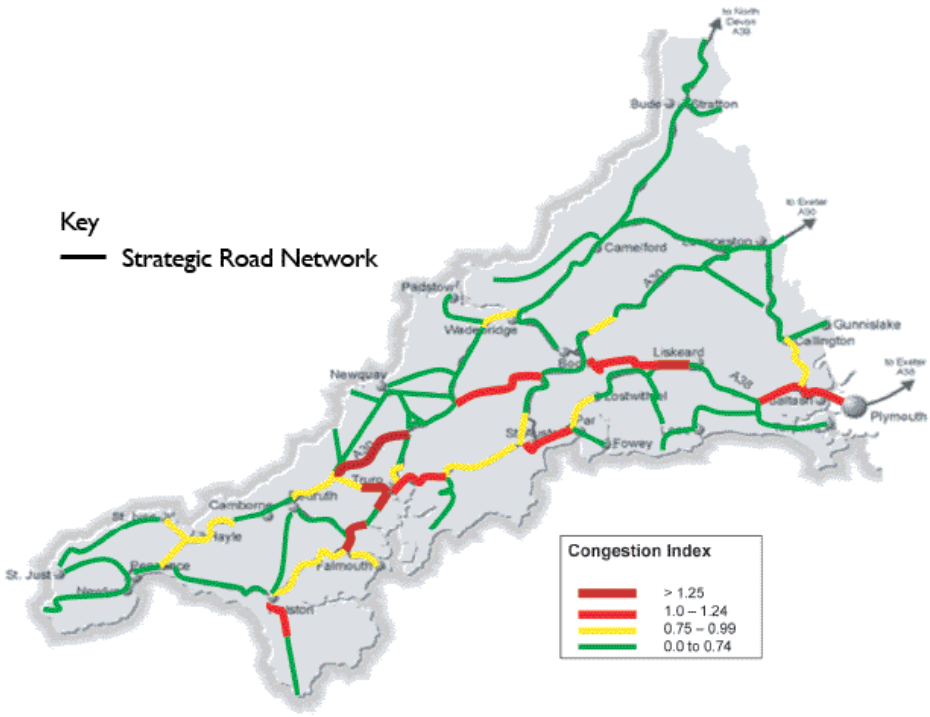


Source – (CCC, 2006b)

7.5. Congestion index in Cornwall – seasonal index

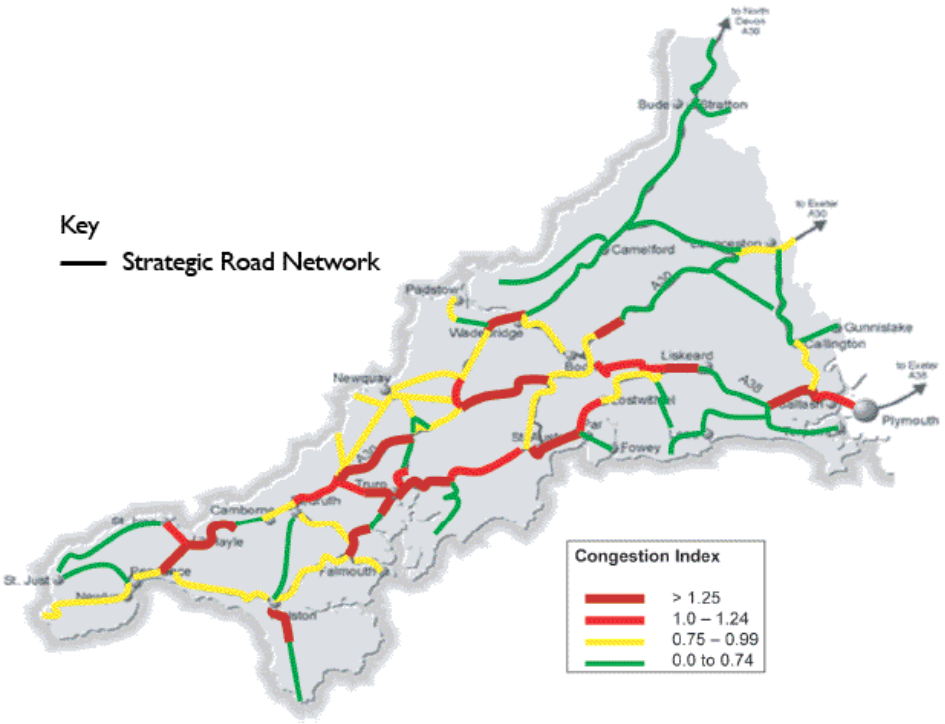
The impact of the flux in traffic flow varies across the County. There are some rural areas which experience little change and certainly not one which causes congestion. However, the major routes into and around the larger settlements such as Truro, Falmouth, St Austell and the Camborne-Pool-Redruth area all suffer traffic flows which are close to or above the road capacity. These roads and others into and around tourist hotpots also suffer congestion or increased congestion during the summer months. Figures 30 and 31 below show the annual average daily traffic flows and the average summer daily flows respectively.

Figure 30 - Annual average daily traffic flows in Cornwall with congestion index



Source – (CCC, 2006b)

Figure 31 - Summer average daily traffic flows in Cornwall with congestion index



Source – (CCC, 2006b)

The number of roads with a higher congestion index during the summer periods is clear to see. The congestion index is based on the capacity of each road type e.g. A-road, Dual carriage way etc and the recorded vehicle numbers on each road. Zero on the congestion index represents no cars on the road and 1 represents the road at full capacity. Anything above one and the road is considered to be congested. The road capacity has been calculated using figures in the Highways Agency's Design Manual for Roads and Bridges.
Many of the roads in Figures 31 have an annual congestion index of 0 – 0.74. Many of the roads fall into the 0.75 – 0.99 index during the summer (Figure 32). There are also several roads in the maximum >1.25 index category around the major towns such as Truro during the summer months. This clearly illustrates the impact of the seasonal influx of tourist traffic on the cornish road network.

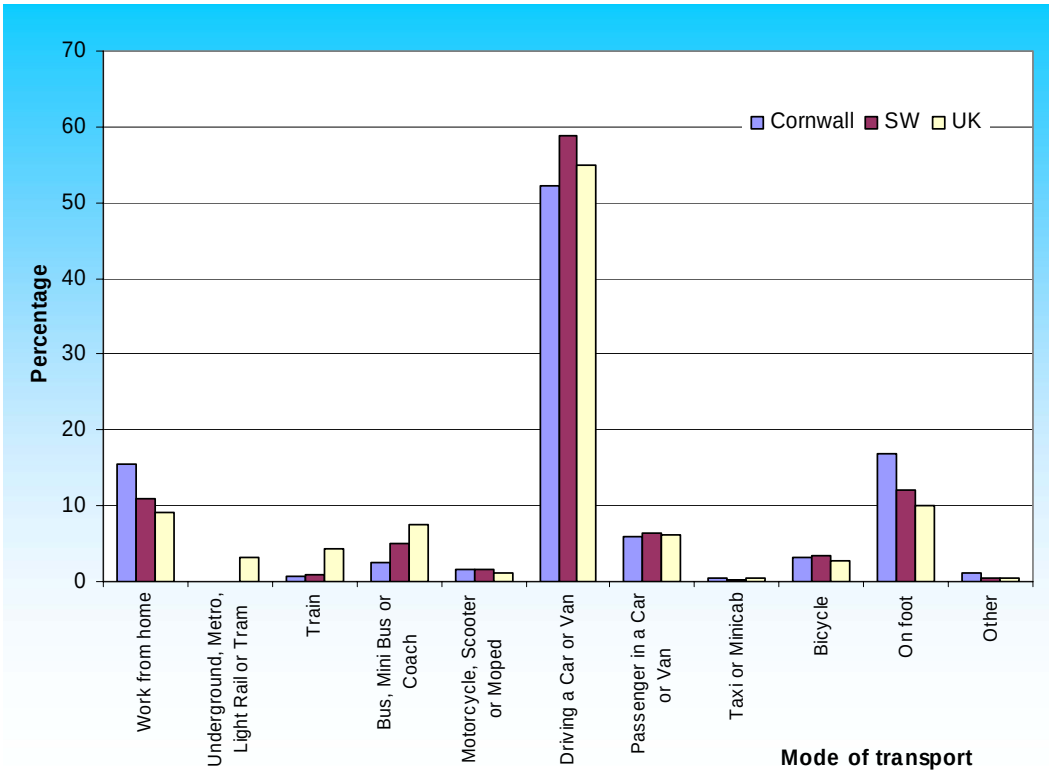
7.6. Travel to work

For most people, commuting to work is a daily practice and with a national average commute distance of 13.3 km (16.6 km in Cornwall) it constitutes a significant number of miles and therefore carbon emissions. Section 7.6.1 looks at the various modes of transport to work chosen in the UK, the South West and Cornwall and the Isles of Scilly.

7.6.1. Modes of transport to work

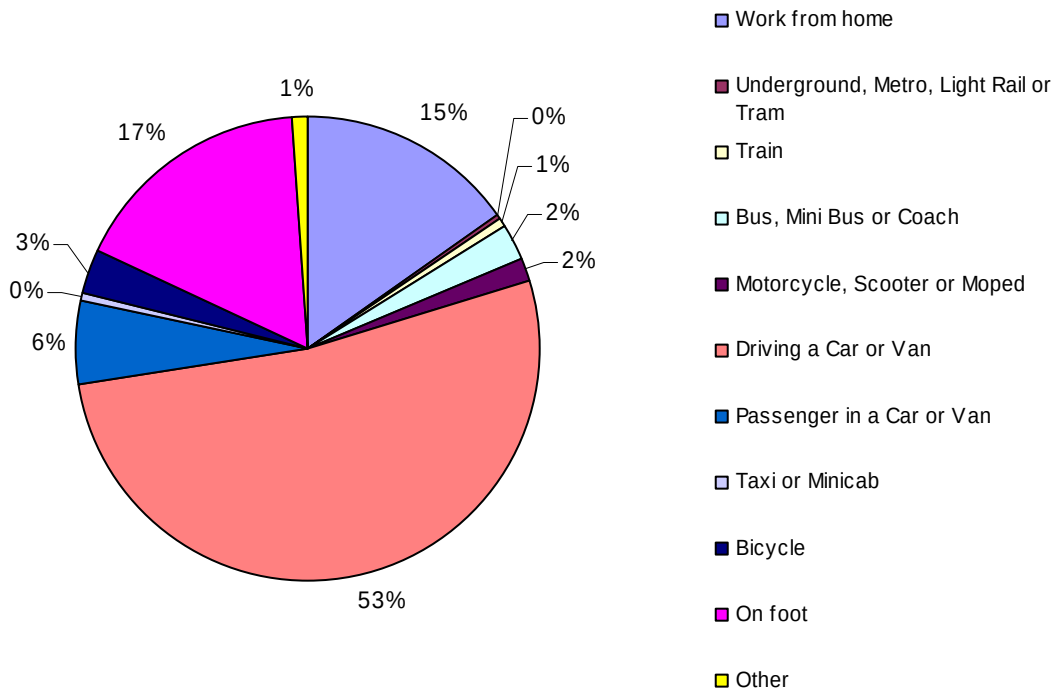
In line with the regional and national average, the most common mode of transport to work in Cornwall is a private car or van, a total of 52% of the County against 55% for the national average. Cornwall has the lowest percentage of people using public transport (train, bus, mini-bus and coach) when compared with the regional and national data. This may be related to the rural nature of the County making the implementation of an efficient and regular service difficult and expensive. The number of people walking to work in Cornwall is almost double the national average, 16.8% against 10% nationally yet the average commute distance in Cornwall is 16.6 km, 3.3 km longer than the national average. Figure 32 compares modes of transport to work in the UK, the South West and Cornwall whilst Figure 33 looks specifically at modes of transport to work in Cornwall.

Figure 32 - Modes of transport to work in Cornwall and the Isles of Scilly, the South West and the UK



Source – Audit Commission, 2007

Figure 33 - Modes of transport to work in Cornwall and the Isles of Scilly

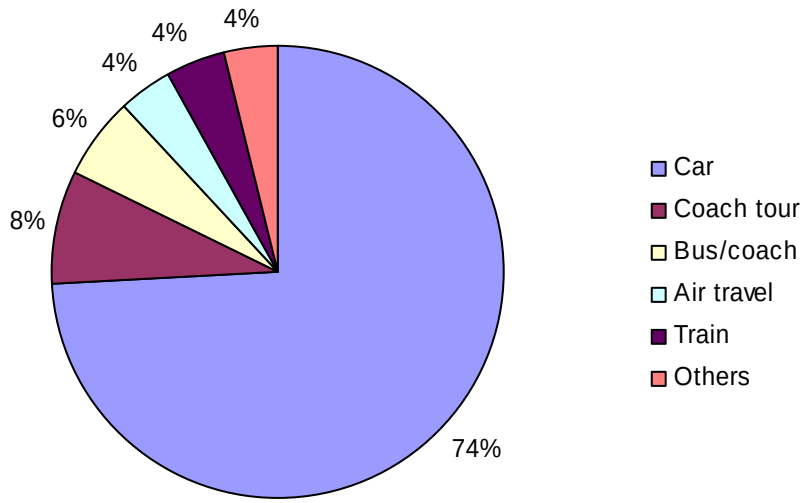


Source - Audit Commission, 2007

7.7. Tourist transport to Cornwall

Cornwall faces seasonal traffic problems brought about by the annual tourist influx which at its height increases the population by approximately 50%. Public service transport to the county is limited and as a result 75% of visitors to Cornwall in 2006/07 came via car (South West Tourism, 2007). Figure 34 below illustrates the modes of transport to Cornwall between July 2006 and June 2007.

Figure 34 - Modes of transport to Cornwall between summer 2004 and spring 2005



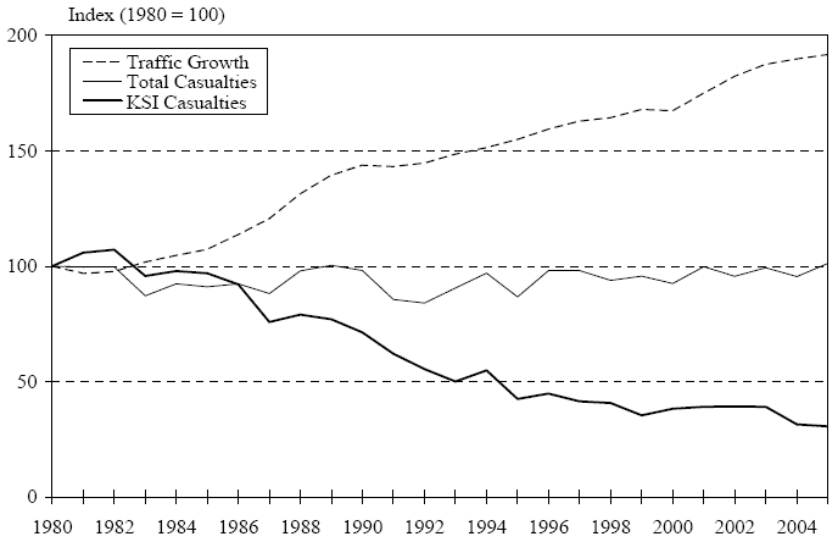
Source – (South West Tourism, 2007)

The impact of 75% of visitors to Cornwall coming by car is clearly outlined in Section 7.5 above, with congestion a significant problem around the larger settlements and tourist hotspots. This number has shown a steady reduction in recent years falling from 90% in the 2000/01 season. The cause of this shift has not been identified.

7.8. Traffic growth and social impacts – collisions

Despite the significant rise in traffic growth in the period between 1970 and 2004 (Figure 27), the total number of casualties overall has remained very similar and the number of killed or seriously injured (KSI) casualties has reduced by more than 50% (Figure 35). If this trend is continued the forecast rise in population and traffic should not result in any increases in death or injury on the roads in Cornwall. This will be monitored as part of the Government's performance framework for local authorities, indicator (NI 47, people killed or seriously injured in road traffic accidents) (DCLG, 2007).

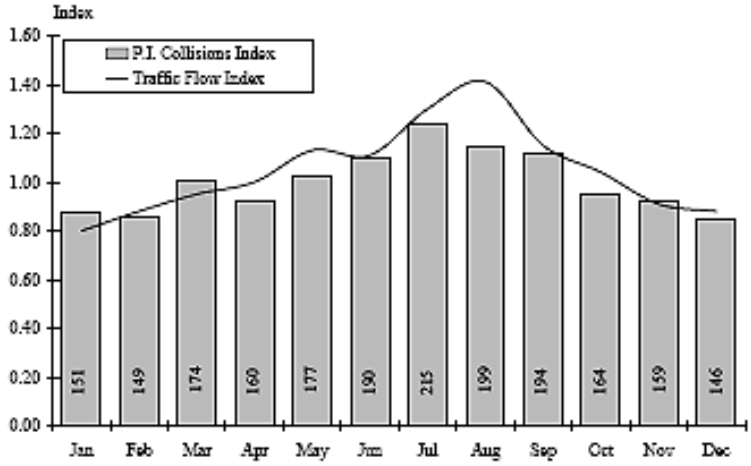
Figure 35 - Traffic growth and numbers of casualties during the period between 1980 and 2005



Source – (CCC, 2006a)

Despite annual traffic growth being decoupled from the number of casualties (Figure 36 above) there was a correlation between the seasonal increase in traffic and the number of Personal Injury (P.I.) collisions in Cornwall in 2005. Figure 36 below illustrates this point with the greatest number of collisions occurring in July and August (coinciding with the peak traffic flow). However, this evidence alone is not enough to forecast the number of collisions if the tourist season alters (i.e. more tourists and spread across a longer season). This would require detailed historic data to better understand the correlation.

Figure 36 - Traffic flow index and number of personal injury collisions in Cornwall in 2005



Source – (CCC, 2006a)

7.9. Traffic growth and social impacts – health

The forecast growth in traffic can be expected to increase emissions to air and this will result in a number of detrimental health impacts. Although Section 3.9.1 shows a national reduction of all seven pollutants included in the Governments National Air Quality Strategy (NAQS), there are cases of pollution hotspots where pollutant concentrations are above the statutory limits. The number of Air Quality Management Areas (AQMAs) (Section 2.9.1) across the UK has been steadily rising with the first declaration in Cornwall occurring in 2005. A second declaration is imminent. Both areas have monitored pollutant (nitrogen dioxide) concentrations above the NAQS

limit which is deemed a threat to health. Without mitigating action to reduce the number of vehicles on the road in Cornwall, increases in traffic would be expected to result in more hotspots being identified and further failures of the Government's statutory air quality limits. Research has identified links between respiratory disease in the young and the elderly, particularly where residents live in close proximity to traffic (WHO, 2005). Increasing traffic may make existing congested areas worse and create new hotspots as roads reach their capacity.

Some have argued pollutant increase will be cancelled by improvements in vehicle technology. This however, is not apparent as early research suggests newer cars are producing higher concentrations of primary nitrogen dioxide, one of the NAQS pollutants (AQEG, 2006).

Perhaps unsurprisingly, research has identified a link between congestion and stress levels in drivers: the more congested the traffic the higher the stress (Hennessy, 1999). This could lead to increased accidents, a reduced quality of life, and perhaps even reduced economic activity as a workers performance suffers after congested commuting, a possible consequence of increased traffic for Cornwall.

7.10. Traffic growth and economic losses

The cost of queuing in traffic is something that has never truly been quantified. There are many factors to be considered but most seek economic losses which include; time, fuel, and vehicle wear and tear. The Confederation of British Industry (CBI) estimates the UK losses £20 b per annum to congestion (Parliament, 2005) but this figure has been questioned by the Department for Transport (DfT) although they, themselves are not able to offer a measure of the cost. Economic losses as a result of congestion specific to Cornwall have not been identified, but the European Transport White Paper has forecast losses due to congestion will double across Europe between 2005 and 2015 (Parliament, 2005). Solutions to this problem include;

- Offering transport alternatives that are safe, efficient and financially similar or cheaper than private cars
- Capitalise on ICT which can reduce travelling therefore eliminating the risk of queuing, reducing environmental impact, and freeing up road space for freight, goods delivery etc
- Build new roads/alter road management to accommodate and better deal with the increasing volume of traffic. This can have negative environmental impacts but as the recent Goss Moor A30 project in Cornwall has demonstrated, careful management and consultation can actually enhance the environment whilst also achieving congestion reduction.

7.11. Newquay airport

All transport and traffic related data in this report have focused on road transport with the emphasis on private vehicles. At present within Cornwall, there has been no detailed comparison of the varying environmental impacts of various modes of transport, performance/age of vehicle stock and the per capita emissions relating to occupancy of the transport etc. A soon to be published report produced by Entec UK Ltd and commissioned by Cornwall County Council will consider and compare the impact of Newquay airport, the proposed expansion and other modes of transport upon Cornwall's greenhouse gas footprint. The Enviro-limits report will therefore not comment the environmental impact of the airport but will instead consider issues which have been identified by independent reports which suggest airport expansion may hinder targets which the Local Authority must achieve for example;

- NI 185 CO reduction from Local Authority operations,
- NI 186 Per capita CO2 emissions in the LA area,
- NI 194 Level of air quality – reduction in NOx and primary PM_{10} emissions through local authority's estate and operations.

A report issued by DEFRA in January 2008 outlined the UK's Green House Gas emissions for 2007. The overall situation was one of no change from 2006 figures. Both business and domestic emissions fell but emissions from energy and transport increased. Emissions from domestic aviation increased by 2.8% whilst emissions from international aviation increased by 1.5%, a result of more flights (DEFRA, 2008). It is anticipated that the

emissions contribution of aviation is likely to continue to increase absolutely and as a proportion of the UK's footprint over the medium term. In consequence, both nationally and within Cornwall, concern has been expressed about the compatibility of airport expansion with a commitment to reducing greenhouse gas emissions. The Entec UK Ltd report will offer some important data which will allow more informed debate regarding the environmental impact of the airport and possible alternatives.

7.12. Transport and traffic – summary

- On current trends, the forecast growth in resident traffic will increase congestion and transport related emissions.
- The forecast growth in traffic may result in more pollution hotspots and subsequent declarations of AQMAs around the County.
- Growing congestion could lead to economic losses brought about by time lost in queues. Congestion could also lead to reduced quality of life.
- Despite the total number of casualties being decoupled from the population growth in Cornwall there is still a relationship between the tourist season peak and the number of personal injury collisions. Growth of the tourism industry may increase the number of personal injury collision further.
- The transport planning process should continue to address the aforementioned issues as well as provide a public transport system which is safe, reliable, affordable and practical in rural areas
- Further investigation of the Newquay airport expansion and the associated impacts is required.

8. LAND USE AND CONSERVATION

Land use and land management is integral to the success and well being of any community. In basic terms, a population can only survive if the land inhabited can provide the essentials required. Since man has developed the ability to share (and eventually trade) resources produced, the constraints on population growth (in wealthy regions) have been removed almost completely.

The following Section will look at the physical land of Cornwall and the Isles of Scilly, the way in which it is used, the habitats it includes and the land designations within its boundaries. This ranges from urban settlements to agricultural land and land which is protected for its environmental credentials. Each of these activities puts a value on the land and the data included in this section will help to identify the value of each land type and activity.

8.1. Cornwall and the Isles of Scilly – land characteristics

The landscape in Cornwall and the Isles of Scilly is renowned for its diversity; from the moors in central and west Cornwall to the rugged coastline of the north coast to the sheltered valleys scattered along the peninsula's southern coast. The total area of Cornwall is 3630 km^2 whilst the Isles of Scilly is just 23 km^2. A total of 2876 km^2 (79%) of the land in Cornwall and the Isles of Scilly is farmed (DEFRA, 2007i). Surrounding Cornwall's peninsula is 697 km of coastline of which 253 km is Heritage Coast.

8.2. Land use in Cornwall and the Isles of Scilly by Local Authority

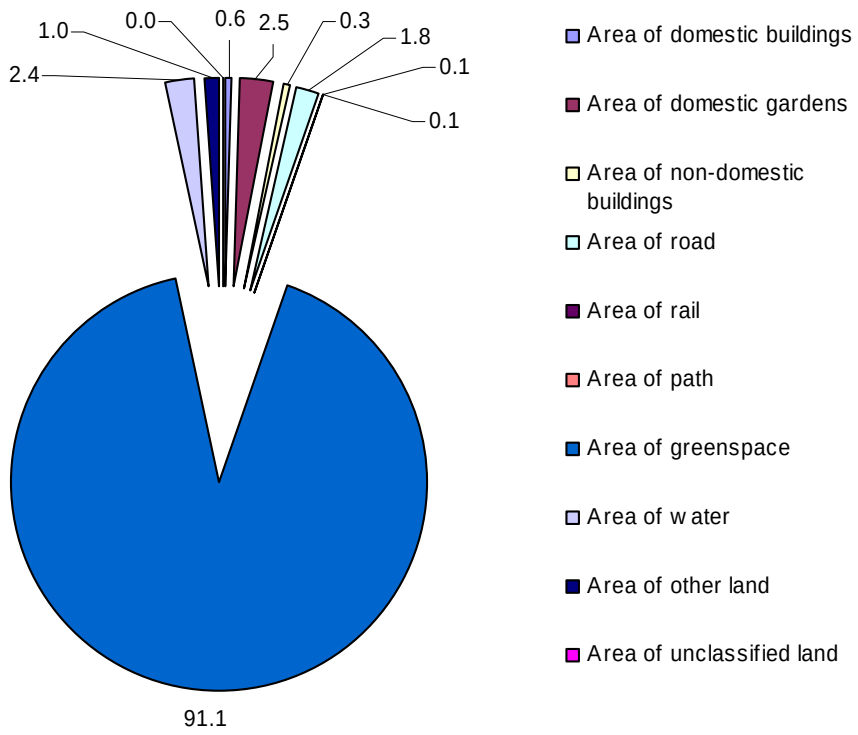
The Government's Office of National Statistics has produced experimental data which breaks land use into several categories. The new data format is more accurate than has been produced in previous years but due to the new way in which the data are generated, cannot be compared with data produced prior to 2005. Table 15 below displays the land use for districts in Cornwall (including the Isles of Scilly) with a summary illustration in Figure 37. Over 91% of the land In Cornwall and the Isles of Scilly is green space, this is a similar proportion to the regional (South West) average of just under 91%.

Table 15 - Land use for Local Authority Districts in Cornwall (including the Isles of Scilly)

	Area of domestic buildings (000 m^2)	Area of domestic gardens (000 m^2)	Area of non-domestic buildings (000 m^2)	Area of road (000 m^2)	Area of rail (000 m^2)	Area of path (000 m^2)	Area of greenspace (000 m^2)	Area of water (000 m^2)	Area of other land (000 m^2)	Area of unclassified land (000 m^2)	Total area of land parcels allocated to each administrative area (000 m^2)
Caradon	3629.68	14512.77	1878.29	12047.13	480.18	339.12	619698.43	25638.01	4886.05	8.41	683118.11
Carrick	3726.33	16474.77	1943.53	10206.76	346.19	334.9	420808.54	12700.78	5348.77	2.13	471892.67
Isles of Scilly	143.71	457.65	40.97	202.45	0	13.64	15339.88	7311.88	93.16	0	23603.35
Kerrier	3835.48	16925.28	2314	10436.13	128.23	409.59	427983.51	7890.87	7439.88	9.81	477372.76
North Cornwall	4879.91	18701.85	2891.23	16515.87	78.06	340.59	1137307.74	19578.6	7875.05	12.71	1208181.59
Penwith	2436.22	9294.07	1348.14	6200.09	270.04	250.66	278500.84	5909.03	3772.54	0.81	307982.42
Restormel	3956.25	15749.31	2269.46	9420.09	709.34	373.08	408086.37	9272.53	7982.25	0.22	457818.86

Source – (DCLG, 2005)

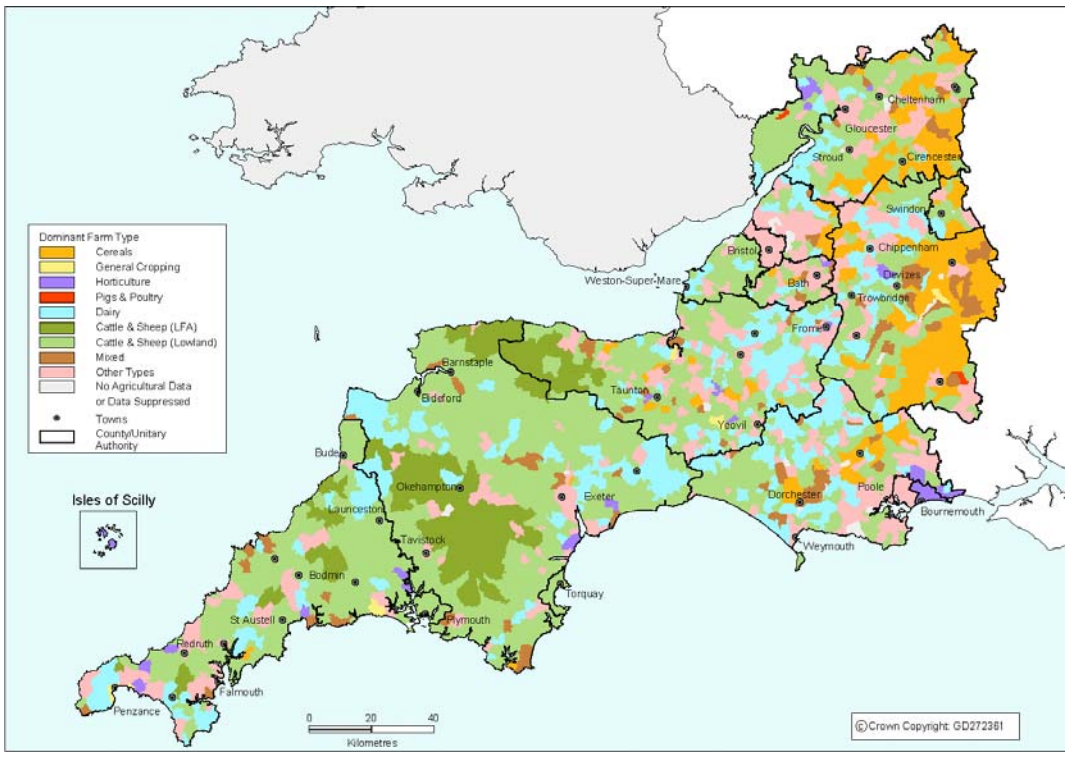
Figure 37 - Land use breakdown in Cornwall and the Isles of Scilly



Source – (DCLG, 2005)

Farmed land in Cornwall and the Isles of Scilly covers 79% of the total area of land in the County (DEFRA, 2007i). Figure 38 shows the extent of farming in Cnrwall and the Isles of Scilly and the dominant farm types.

Figure 38 - Dominant farm type in the South West region – 2005

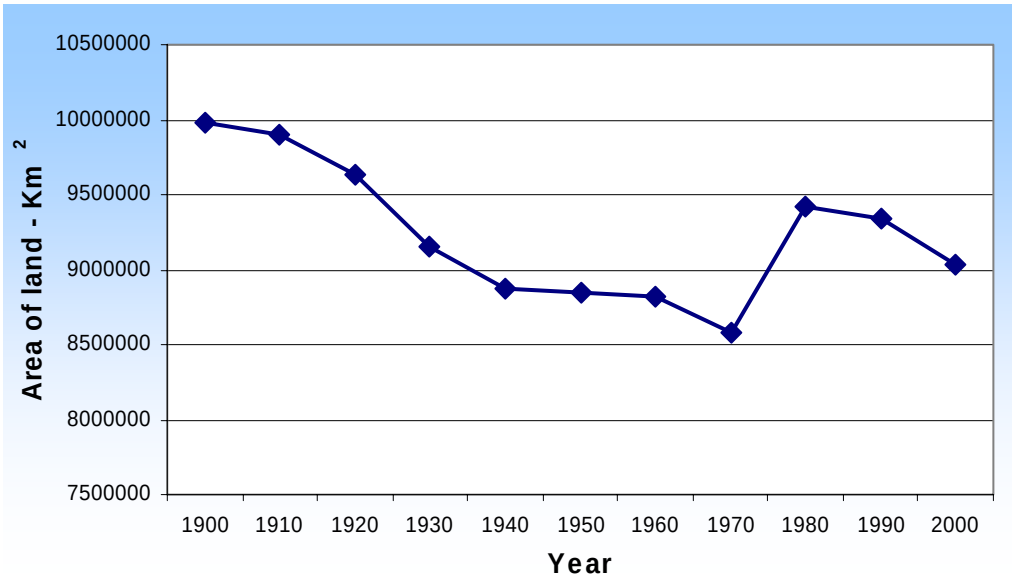


Source – (DEFRA, 2005)

8.3. Agriculture

Data recorded in the Agricultural Census over the last century helps to visualise the trend for agricultural land use area. The Agricultural Census is recorded every 10 years and provides detail on farming activity across the country and includes; area of land, specific land use (e.g. crops grown, live stock type and numbers) as well as economic data regarding labour, full time jobs etc. Figure 39 below displays the area of land farmed in England since 1900. A constant decline in area between 1900 – 1970 is clear but a sharp, albeit temporary rise in area was recorded in 1970. In the period between 1980 and 2000 the steady reduction in farmed area is resumed.

Figure 39 - Area of land farmed in England between 1900 and 2000

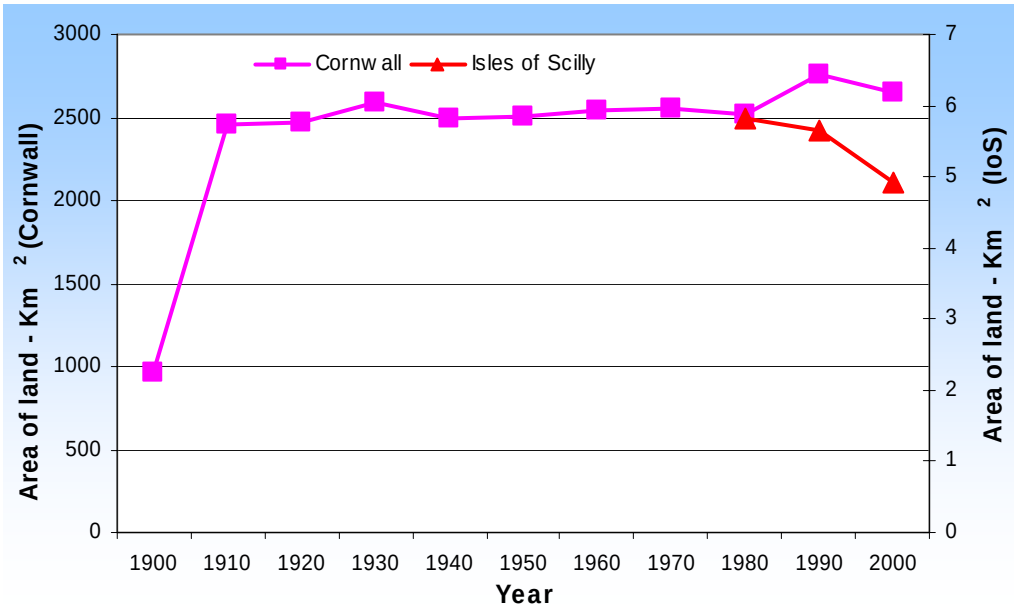


Source – DEFRA, 2007j

8.3.1. Agriculture (1900 – 2000) – Cornwall and the Isles of Scilly – trends

The decline in agricultural land nationally has not been reflected in Cornwall and the Isles of Scilly. At the beginning of the 19th century (1900 – 1910) the data indicate a sharp rise in land used for agriculture. This may be due to a shift from the mining industry as the price of tin began to fall. Between 1910 and 2000 the area of land in Cornwall used for agriculture was around 2500 km^2 (69% of the land in Cornwall) with a peak in 1990 of 2758 km^2. Data for the Isles of Scilly was not available before 1980 but the data for the past 20 years shows a decline in land used for agriculture from 6 km^2 in 1980 top just under 5 km^2 in 2000 (see Figure 40). The amount of land used in Cornwall and the Isles of Scilly used for agriculture is further evidence to support the importance of farming and its more recently acknowledged role in conserving the environment in Cornwall.

Figure 40 - Area of land used for agriculture in Cornwall and the Isles of Scilly



Source – DEFRA, 2007j

8.3.2. Agricultural and conservation

Agriculture in the UK has and is responsible for quite literally shaping the surface of the land. Almost 77% of the land surface is farmed creating huge potential for impacting upon habitat and biodiversity (DEFRA, 2006c). Indicators such as bird population and habitat area have shown declines which can be related to farming practice and land management. To minimise further disruption and in some areas reverse the trend of recent years, numerous schemes have been put in place to support and in some cases reward agricultural practice that encourages the redevelopment and maintenance of habitats which support biodiversity. Such schemes include the UK Biodiversity Action Plan, the Countryside Stewardship Scheme and the introduction of organic farming which are supported by DEFRA, Natural England, the RSPB and the EA (DEFRA, 2006d).

In 2005, the Countryside Stewardship Scheme (CSS) was replaced by Environmental Stewardship Scheme (ESS). The CSS's aim was to,

> "*Improve the natural beauty and diversity of the countryside, enhance, restore and re-create targeted landscapes, their wildlife habitats and historical features, and to improve opportunities for public access*" (DEFRA, 2006d).

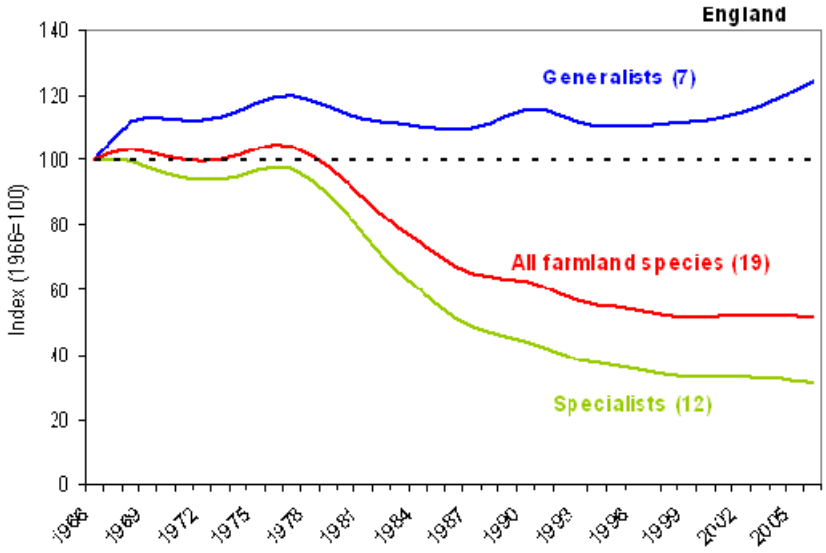
The CSS was a single level voluntary scheme with the same criteria applying to everyone that was awarded the grant. Those who applied for the CSS were bound to a 10-year agreement and were paid an annual flat rate. The new ESS features three levels of stewardship, Entry Level (ELS), Organic Entry Level (OELS) and Higher Level (HLS). There is some concern that farmers will opt for the ELS as opposed to the OELS or HLS since this is the easiest to achieve. The concern is whether there is sufficient budget available to ensure sympathetic management of high-value biodiversity and habitat.

8.3.3. Set-aside and habitat loss

The compulsory Set-aside scheme which has provided habitat for a variety of wildlife (in particular farmland birds) ceases in 2008. In 2006, 63 km^2 of land in Cornwall and the Isles of Scilly was Set-aside. Potentially all of this important habitat will now be lost and may have further impacts on particularly vulnerable species such as farmland birds. The Government's wild bird population update for 2006 (published in 2007) shows specialist farmland bird populations are at an all time low (Figure 41). The RSPB are keen to work with farming communities to help

provide appropriate habitat for farmland birds as the agricultural landscape changes but more financial resources need to be identified if this vital intervention is to be achieved.

Figure 41 - Farmland bird populations between 1966 – 2006



Source – (DEFRA, 2007k)

8.3.4. Agriculture - Biofuels and the competition for land

If the Government is to reach its proposed target of 20% of UK energy derived from renewable sources by 2020 (DTI, 2007b) there needs to be significant investment in renewable technology. This includes the use of biofuels which will require significant land for production. According to the National Farmers Union, the UK agricultural industry has enough spare land to meet the demand of the Renewable Transport Fuel Obligation of 5% transport fuel from bio-fuel in 2010 without putting pressure on food production (NFU, 2007b). Progress must be with caution as the rise in American corn price (doubled in 8-months) evidences the need for careful management. In the USA approximately 14% of the corn crop was used to produce just 2% of the gasoline consumption (Milmo, 2007). In October 2007, UN independent human rights expert Jean Zeigler argued that a five-year freeze on biofuel production should implemented (UN, 2007). Although accepting the environmental benefits of biofuel production, Zeigler points out the "absolutely catastrophic" impact on poor nations if food prices continue to rise as a result of demand for bio-fuel. Although this is taking place on a national and international scale, rising food prices still impact upon Cornwall and the Isles of Scilly.

In addition to this, the land used for biofuel production would reduce the environmental services offered, for example as a habitat, a carbon sink, a flood plain, or an area which benefits social well being. The Sustainable Development Commission recognises,

> *"The challenge for sustainable development is to manage land so as to integrate and maximise its economic, social and environmental value".* (SDC, 2007)

8.4. Nature conservation areas

Land designations play an important part in the conservation of wildlife habitat, securing areas for valuable scientific research and providing areas for recreation (DEFRA, 2006c). Legislation including the Wildlife and Countryside Act 1981 and the Countryside Rights of Way Act 2001 have enabled the protection of thousands of square kilometres across the country to be protected from development and activity which could have a negative impact.

Many of the designations overlap geographically because specific species or habitats will often fall into broader areas of protection.

8.4.1. Land designations in Cornwall and the Isles of Scilly

As mentioned in Section 8.2 and illustrated in Figure 37, 91% (3307 Km^2) of the land in Cornwall and the Isles of Scilly is classified as greenspace. Within that greenspace is diverse and valuable land which has the benefit of numerous designations, depending on the detail and features of each area. Farmed land equates to 79% of land in Cornwall and Isles of Scilly and therefore a significant proportion of greenspace is managed by farmers and foresters etc. The preservation of many of the designated land areas can only be achieved with co-operation from the agricultural industry. If the environmental quality were to deteriorate there would no doubt be repercussions for the tourism industry. Holistic, long-term strategies must be employed when changes within these sectors are planned. The following sections will look at various designations, area, number etc across Cornwall and the Isles of Scilly.

Tables 16 and 17 below outline the major land designations in Cornwall and the Isles of Scilly respectively.

Table 16 - Land designations in Cornwall

Land designation		Area	Length	Number
Cornwall				
Total land area		3630 Km^2	-	-
Site of Special Scientific Interest	Area in Cornwall	198 Km^2	-	-
	% of land in Cornwall	5.5	-	-
	% Area favourable	55.3	-	-
	% Area unfavourable recovering	32.7	-	-
	% Area unfavourable no change	6.2	-	-
	% Area unfavourable declining	5.0	-	-
	% Area destroyed / part destroyed	0.1	-	-
AONB	Area in Cornwall	958 Km^2		-
Natural nature reserves		10.5 Km^2	-	3
Local nature reserves		2.7 Km^2	-	11
RSPB reserve		-	-	2
World Heritage Sites		198 Km^2	-	10
Total length of coastline		-	697 Km	-
Length of Heritage Coast		-	253 Km	-

Source – Natural England, 2007(a, b), Cornish Mining, 2006

The environmental quality of Cornwall is reflected by the area of land (almost one third of the total) protected by various designations. These designations not only serve to protect landscapes, habitats and biodiversity but also provide marketing opportunities for goods and services. The recently won World Heritage Site status for 10 areas in Cornwall opens a wealth of opportunities as well as responsibilities.

Table 17 - Land designations in the Isles of Scilly

Land designation		Area	Length	Number
Isles of Scilly				
Total land area		23.6 Km^2	-	-
Site of Special Scientific Interest	Area in Isles of Scilly	5.6 Km^2	-	-
	% of land in Isles of Scilly	90.3	-	-
	% Area favourable	9.7	-	-
	% Area unfavourable recovering	-	-	-
	% Area unfavourable no change	-	-	-
	% Area unfavourable declining	-	-	-
	% Area destroyed / part destroyed	-	-	-
AONB	Area in Isles of Scilly	23.6 Km^2		-
Natural nature reserves				
Local nature reserves				
RSPB reserve				
Total length of coastline		-	67 Km	-
Length of Heritage Coast		-		-

Source – Natural England, 2007(a, b)

The value of land designations could not be more apparent than in the Isles of Scilly. Tourism use of the AONB which covers the entire island chain contributes as much as 85% of the local economic revenue (IoSAONB, 2006).

8.4.2. Nature conservation designations in Cornwall and the Isles of Scilly – Mapped

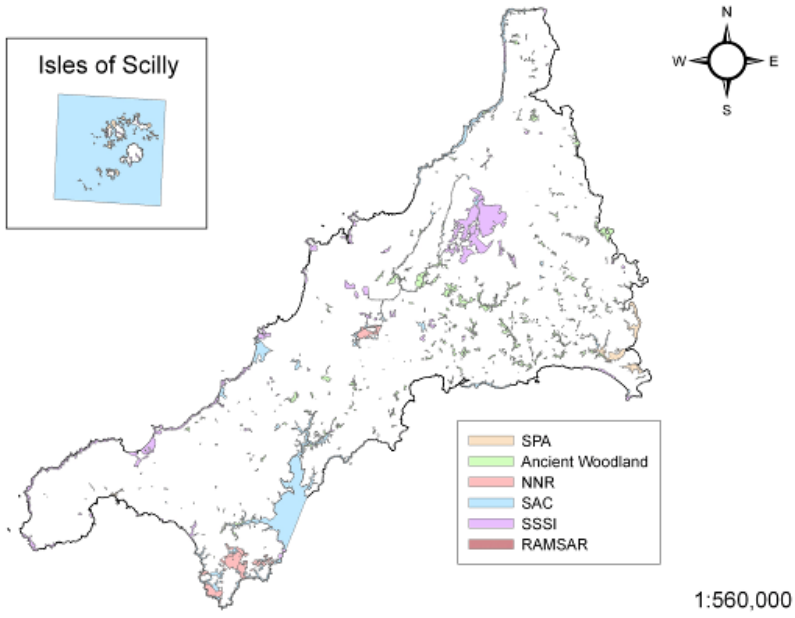
Using Geographic Information System (GIS) data from Natural England, it is possible to map some of the nature conservation designations in Cornwall and the Isles of Scilly. The area of land covered by each designation is included in Table 18 below and the map is displayed in Figure 42. Figure 42 illustrates how fragmented the designations are but "hotspots" include Bodmin moor (SSSI), the north Cornwall coast between West Pentire and St Ives (SAC), National Nature Reserves on the Lizard Peninsula and the Isles of Scilly (SSSI).

Table 18 – Nature conservation designations in Cornwall and the Isles of Scilly

	Designation	Area Km^2
Cornwall and the IoS	SSSI	19653
	RAMSAR	401
	SPA	2394
	SAC	41212
	NNR	2459

Source – Natural England, 2007b

Figure 42 - Location of nature conservation designations in Cornwall and the isles of Scilly

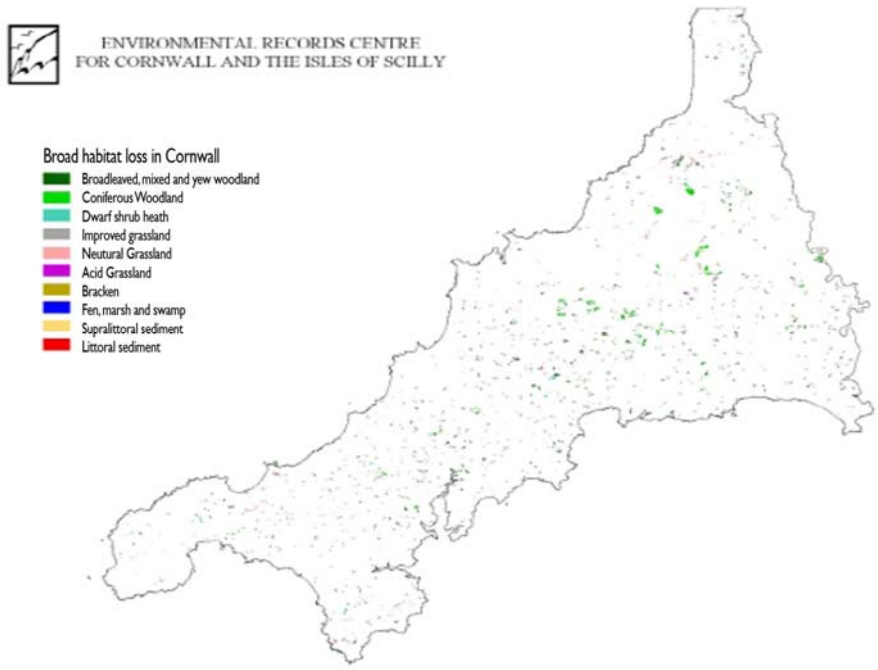


Source – Natural England, 2007b

8.5. Trends in land-use and habitat

In 1988 and 1995 the Environmental Records Centre for Cornwall and the Isles of Scilly (ERCCIS) undertook a land cover mapping project. The project used a range of data from habitat surveys to aerial photography to create digital maps of the county which can be used to identify the land cover in Cornwall and the Isles of Scilly. This is used to accurately quantify the land cover which can then be interpreted as habitat and with further analysis, figures regarding biodiversity can be estimated. The mapping projects in 1988 and 1995 were used to identify the land use changes and habitat loss (See Figure 43 below).

Figure 43 - Broad habitat loss in Cornwall, 1988 – 1995



Source – (CCC, 2002)

Unfortunately, due primarily to lack of funding and resources ERCCIS has not been able to update the land cover mapping project since 1995 and therefore no further changes in land-use and habitat have been identified using this method.

8.6. Housing expansion

The total number of properties planned to be built in Cornwall between 1996 – 2016 is 40,000. However, the exact location of the developments and land type on which the developments will occur was not forecast in the Cornwall Structure Plan 2004, and it is therefore very difficult to estimate the potential environmental impacts and pressure on land otherwise used for food production. There is an economic indicator that agricultural land may in the future be lost for the development of housing as the price of land is forecast to rise considerably. The Valuation Office Agency (VOA) forecast a 30% rise in the price of agricultural land (unequipped) between July 2007 and July 2012 (VOA, 2007). Given the uncertainties associated with the agricultural industry and the unpredictable impacts of climate change the option to sell agricultural land may become more financially attractive and could result in higher food prices. Further loss of habitat will be unavoidable.

8.7. Land use and conservation – summary

- Increasing population and the associated growth in demand for homes will put further pressure on agricultural land. There will also be increasing financial incentives to sell land as the demand and price rises.
- Demand for land to develop housing could lead to lost habitat and reduction in biodiversity.
- Competition for agricultural land use will increase as the Government aims to reach its target for renewable fuel.
- Increased frequency of extreme weather events will lead to reduced crop yield which in turn will increase food prices, reduce indigenous production and increase reliance on imported food.
- Developing the Land Mapping Project will provide regular and accurate data regarding land use change in the County.

9. BIODIVERSITY

Biodiversity conservation is included in the Government's sustainable development indicators as a means of measuring changes in the environment (DEFRA, 2007a). Priority species and habitats are monitored in terms of their status i.e. whether they're declining, stable or, increasing and at what rate. Since 2002, the status of priority species and habitats in the UK has been deemed by DEFRA to be showing clear improvement. Achieving biodiversity conservation is in the interest of any persons, business or industry related to the environment directly or indirectly (which includes just about everyone). There are economic gains to be had from utilising high quality environments for industries such as agriculture and tourism and there are social benefits such as improved quality of life.

The UK Biodiversity Action Plan was set up to help meet targets from global to local level with action plans tailored to each area. Local Action Plans will include national indicators e.g. farmland birds and will also include indicators more relevant to the local environment.

9.1. Future monitoring – Government National Indicators

Local biodiversity action plans are likely to play a significant role in the Government's new performance monitoring framework. The new National Indicators system (NI) includes 14 indicators within the Environmental Sustainability category of which the most important here will be *NI 197 local biodiversity – active management of local sites*. The new set of indicators will be in place in April 2008 when the old indicators e.g. Best Value Performance Indicators will be abolished (DCLG, 2007).

Issues regarding the appropriateness of the new National Indicators have been raised, with concerns they will not meet the requirements of local areas.

9.2. Cornwall Biodiversity Action Plan

The Biodiversity Action Plan (BAP) for Cornwall was adopted by the Biodiversity Initiative Project in conjunction with the Cornwall Wildlife Trust. Three phases of this project have been completed and this constitutes the full Cornwall BAP. The plan includes 124 species and 25 habitats; the full list can be viewed at http://www.cornwallwow.org.uk/bap3/quickbap3.htm. A review of the Cornwall BAP will take place in 2008 with completion anticipated for summer 2008. The key issues which have been proposed (but not yet agreed by the project funders Natural England) for this review are;

- The Cornwall BAP Volume 3 was produced in 2004 but there has not yet been a review of progress against the plan. This means that there is not have a clear idea in the County as to how well we are doing against habitat and species action plans.
- The new habitats and species list for the UK BAP is extensive and the Cornwall BAP needs to be updated to incorporate the new habitats and species relevant to Cornwall.
- The resultant amended Cornwall BAP Volume 3 will contain many more species and habitats. There is a need to prioritise the plans for example some rarities on protected sites may not need action and some species will be adequately covered by habitat management work. A priority list will pick out those species and habitats that require priority action and that should form the basis of new projects.

9.3. Biodiversity data for Cornwall and the Isles of Scilly

Following a review of the available data for Cornwall and the Isles of Scilly as well as discussions with groups responsible for collecting the data, several issues have been identified which led to the decision to not include biodiversity data for Cornwall and the Isles of Scilly in this report. The decision comes from a lack of current data with the expert analysis required to give value. There is little point in creating an evidence base, based on data which cannot be used for future planning in Cornwall and the Isles of Scilly.

9.4. Biodiversity – summary

Biodiversity data for Cornwall and the Isles of Scilly is well documented. What is not available is interpretation of this data. If the extensive data base is to be utilised, annual interpretation is required to identify trends and to provide up-to-date information. To achieve this quite simply requires more human resources; such investment will provide invaluable outcomes.

10. FRESH WATER ENVIRONMENT

Water quality around the coast of Cornwall and in Cornwall's freshwater networks has significant value as a habitat, an economic resource, and as a recreational environment. To maintain and (where the situation dictates), improve the water quality, the Environment Agency set targets which, if not met, will require mitigating action to remedy the problem(s). This section reviews freshwater quality in Cornwall and where possible identifies the current status and recent trends in various measures of quality.

10.1.1. River water quality – indicators

The Environment Agency has set River Quality Objectives (RQO) for a total of 40,000 km of rivers in England and Wales. Each target is set so that

"…*the river will reliably support the type of fishery that we would like to see maintained there. If a river achieves this target we are confident that it will also nearly always meet our requirements for wildlife and conservation, for recreation, and for abstraction for irrigation and the water supplies we use, after treatment, in our homes and businesses.*" (DEFRA, 2007l).

In order to exercise compliance with RQO the Environment Agency samples water quality in rivers and canals across the country. Samples are taken every month to determine the biological, chemical and nutrient quality of the water. Lengths of river are graded A (very good) to F (bad) when monitoring biological and chemical quality. Nutrients (nitrates and phosphates) are graded 1 (very low presence of nutrients) to 6 (very high presence of nutrients) (EA, 2007a). Biological and chemical river water quality is number 30 in the Government's sustainability indicators document (DEFRA, 2007a). Biological quality is calculated by identifying macroinvertebrates present at each monitoring point; scores range between A (biology similar to that expected for an unpolluted river) to F (biology limited to a small number of species very tolerant of pollution). The sensitivity of macroinvertebrates to changes in water quality mean that their presence or absence can identify pollution where chemical analysis of water quality samples cannot. Chemical water quality is measured by the concentrations of dissolved oxygen, biochemical oxygen demand and ammonia (EA, 2007b).

Nutrients (nitrates and phosphorus) are essential for aquatic life. However, if they are present in excess at a critical ratio to be used by plant life, the accumulation of nutrients leads to the eutrophication of the water course. This has damaging and long lasting impacts on the invertebrates present and the habitat in general.

10.1.2. River water quality in Cornwall and Isles of Scilly – chemical

Using the Environment Agency criteria referred to above (Section 10.1.1) more than 75% of river length in Cornwall and the Isles of Scilly were graded "good quality" in 2005 with just 2.7% deemed "bad quality". However, since 2002, the total length of river achieving good quality has reduced by 4% whilst the length of river achieving fair quality has increased by 4.5% indicating a slight decrease in chemical river water quality at the top of the scale (Table 19).

Table 19 - Chemical water quality in Cornwall and Isles of Scilly between 1990 and 2005 – graded by percentage of river length

	Year						
Grade	1990	1995	2000	2002	2003	2004	2005
bad quality	3.29	1.92	0.88	1.35	1.26	2.92	2.71
poor quality	4.68	3.98	4.56	3.75	4.73	2.06	2.09
fair quality	13.29	16.12	15.27	14.48	14.07	17.82	19.00
good quality	78.73	77.99	79.29	80.42	79.93	77.20	76.20

Source – (South West Observatory, 2007a)

10.1.3. River water quality – biological

Biological water quality in Cornwall and the Isles of Scilly is deemed "good" for more than 90% of the total river length. Like chemical water quality the trend in recent years has been a slight decrease in the length of river achieving good status with 2002 being the peak biological quality year (Table 20).

Table 20 - Biological water quality in Cornwall and Isles of Scilly between 1990 and 2005

	Year										
Grade	1990	1995	1997	1998	1999	2000	2001	2002	2003	2004	2005
bad quality	0.20	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.34	0.34	0.34
poor quality	0.96	0.45	0.63	0.28	0.00	0.00	0.00	0.00	0.00	0.01	0.00
fair quality	17.17	8.27	10.30	9.16	9.51	7.72	7.77	6.67	7.41	8.19	8.90
good quality	81.67	91.18	88.96	90.55	90.49	92.28	92.93	93.33	92.24	91.45	90.76

Source – (South West Observatory, 2007b)

10.1.4. River water quality – nitrates

Samples were taken at numerous points along rivers in Cornwall and a grade returned for each location. Table 20 below details the nitrate grades on rivers in Cornwall and the Isles of Scilly between 1993 to 2005. The majority of sampling points returned grades of 3 or 4 (moderate or high concentrations or fair to poor quality).

Table 21 - Nitrate grades at sampling points in rivers in Cornwall and Isles of Scilly

	Year						
Grade	1993/95	1998/00	1999/01	2000/02	2001/03	2002/04	2003/05
1	24	19	18	16	16	16	16
2	75	53	64	71	63	49	57
3	121	136	132	132	145	152	146
4	141	144	150	148	140	148	146
5	36	39	33	32	35	34	34
6	10	18	13	11	11	11	11

Source – (EA, 2007c)

10.1.5. River water quality – phosphates

Samples were taken at numerous points along each river and a grade returned for that location. Table 22 below details the phosphate grades on rivers in Cornwall and the Isles of Scilly between 1988 to 2005. The majority of sampling points returned grades of 1 or 2 (very low or low concentration).

Table 22 - Phosphate grades on rivers in Cornwall and Isles of Scilly from 1988 to 2005

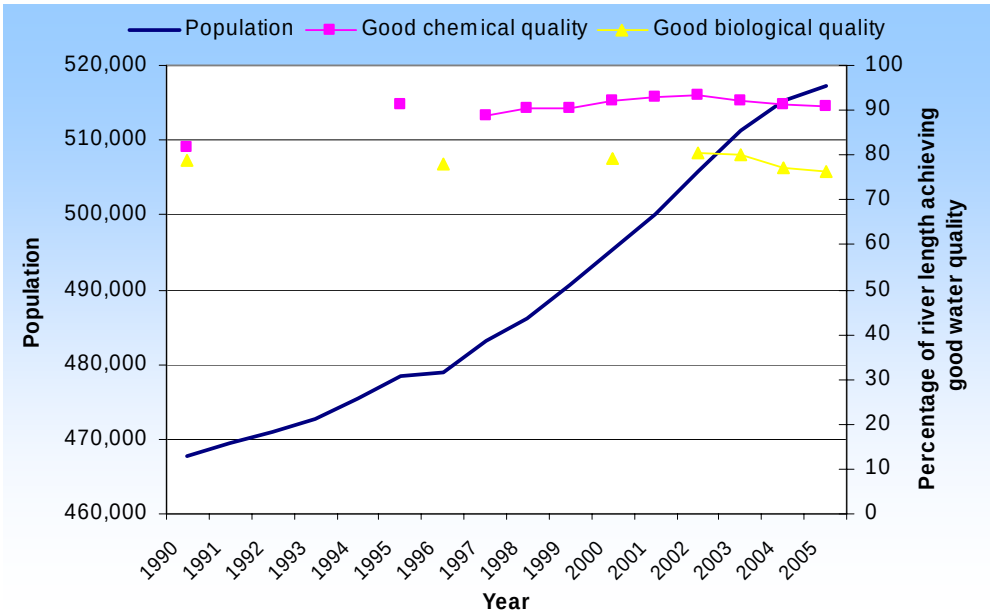
	Year							
Grade	1988/90	1993/95	1998/00	1999/01	2000/02	2001/03	2002/02	2003/05
1	65	91	125	137	111	97	67	102
2	136	228	203	188	208	218	195	169
3	41	41	62	56	57	53	51	42
4	60	38	34	35	37	48	50	47
5	57	44	29	39	45	42	18	27
6	11	7	3	4	1	1	1	1

Source – (EA, 2007c)

10.2. River water quality – biological and chemical water quality and population growth

The data in Sections, 10.1.2 and 10.1.3 show the biological and chemical water quality in rivers in Cornwall are either stable or improving. Figure 44 below shows the percentage of river length in Cornwall achieving good quality between 1990 and 2005 plotted alongside the population growth of the county during the same period.

Figure 44 - Biological and chemical river water quality and population growth between 1990 – 2005



Source – (Miller, 2006), (South West Observatory, 2007a, b)

Due to the rather intermittent nature of the data collected for river water quality between 1990 and 1998, correlation between the population growth and river water quality is hard to ascertain. However, using the data that *is* available it would seem the growth of Cornwall's population (10.6% between 1990 and 2005) has had limited impact, with chemical quality improving by 9% in the 15 year period and biological quality having an overall decrease of 2%.

10.3. River water quality – nitrate and phosphate concentration and population growth

Similar to the biological and chemical river water quality, the concentration of nitrates and phosphates does not suggest any impact associated with the growth in population. The concentration of nitrates has remained very similar during the period between 1998 and 2005 with just a slight increase (10, out of 146) in the number of monitoring points at grade 3 (moderate concentration). The same is true of the phosphate concentrations where the most significant change (~50% increase) is an increase of monitoring points of grade 4 (high); an increase from 7% to 12%.

10.4. River water quality – decoupled from population growth

The data in the previous Sections and in Figure 44 indicate how population has grown without severely impacting upon the river water quality in Cornwall. Without a more complete data set it is difficult to see any long term trends but it would seem that either population growth has not impacted significantly on water quality or that land management employed by agriculture and sewage treatment has countered any potential degradation of quality. This is supported by a report published in 2004 by Park *et al.* which that found a 40% increase in income (associated with population growth) would result in a 1% decrease in chemical water quality.

10.5.Urban Waste Water Treatment

The European Urban Waste Water Treatment directive requires sensitive areas where waste water is released to be monitored and action taken where necessary to prevent or mitigate build up of nitrates and phosphates which could cause the water to become eutrophic (EA, 2007g). Target concentrations for either nitrogen or phosphorus or both are set for areas identified as sensitive. In Cornwall four areas have been identified, three with targets for phosphorus and one for nitrogen. Table 23 details the sensitive area, the target nutrient and the target grade.

Table 23 - Sensitive areas in Cornwall highlighted under the Urban Waste water directive

Sensitive area	Target nutrient	Target grade
East Looe (Liskeard)	Phosphorus	2
River Cober / Loe Pool	Phosphorus	2
St Austell river	Phosphorus	2
Truro/ Tresillian/ Fal Estuaries	Nitrogen	2

Source – (EA, 2007c)

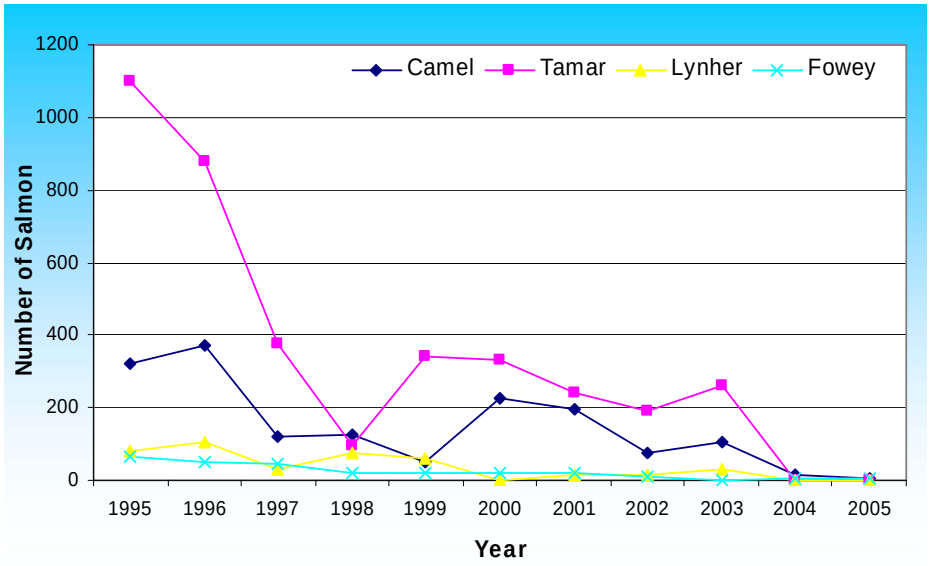
10.6.Salmon and sea trout stocks

The presence of salmon and sea trout (salmonids) is an indicator of good river water quality. In the Thames and South East regions, the EA uses salmon and sea trout stocks as an environmental indicator (EA, 2007d). In the South West and Cornwall, salmon and sea trout stocks are not only a useful indicator of water quality but also provide valuable income for the economy via the angling industry. In the 2005/06 season (April 1st 2005 – March 31st 2006) the total number of salmon and sea trout licenses purchased in the South West was 3607, worth £152,499 (EA, 2005). In Cornwall the salmon and sea trout fisheries consist of the Rivers Tamar, Camel, Lyhner and Fowey. Sea trout may also be fished for with rod and line in the River Looe. The following section looks at salmon and sea trout catches by various methods and the associated effort between 1995 and 2005 in the Cornish fisheries.

10.6.1. The relationship between net caught salmonids and the corresponding effort in Cornwall, 1995 – 2005

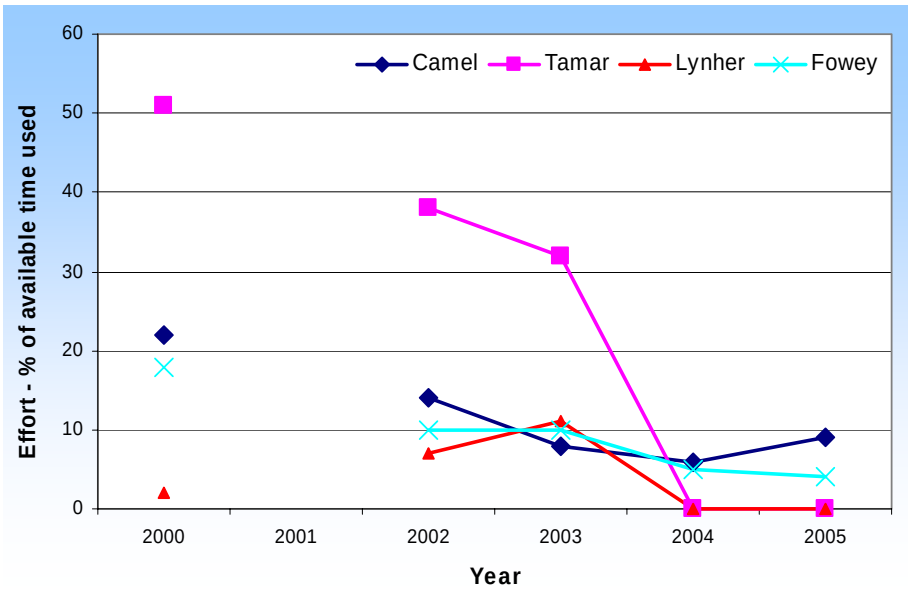
The trend for numbers of salmon and sea trout caught by net (drift and seine) in Cornwall between 1995 and 2005 has seen a sharp decline. The total number of salmon caught in 1995 from the Cornish salmonid fisheries was 1294. This figure fell to 11 in 2005. However, this figure needs to be interpreted in relation to fishing effort. In 2000 (data prior to 2000 are not available) the utilised effort on the Tamar was 51% and 287 salmon were reported. In 2004 the number of reported salmon caught from the Tamar was 0 which reflects the effort which equated to zero days net fishing. A very similar pattern exists with the number of sea trout reported correlating with the effort. Figure 45 illustrates the number of salmon and sea trout caught by net between 2000 and 2005 on the various rivers in Cornwall. Figure 46 shows the effort fished each year. The association between the numbers of fish reported and the effort is clear.

Figure 45 - Numbers of net caught salmon and sea trout in Cornwall between 1995 and 2005



Source – (EA, 2005)

Figure 46 – Effort reported whilst net fishing for salmon and sea trout in Cornwall between 2000 and 2005



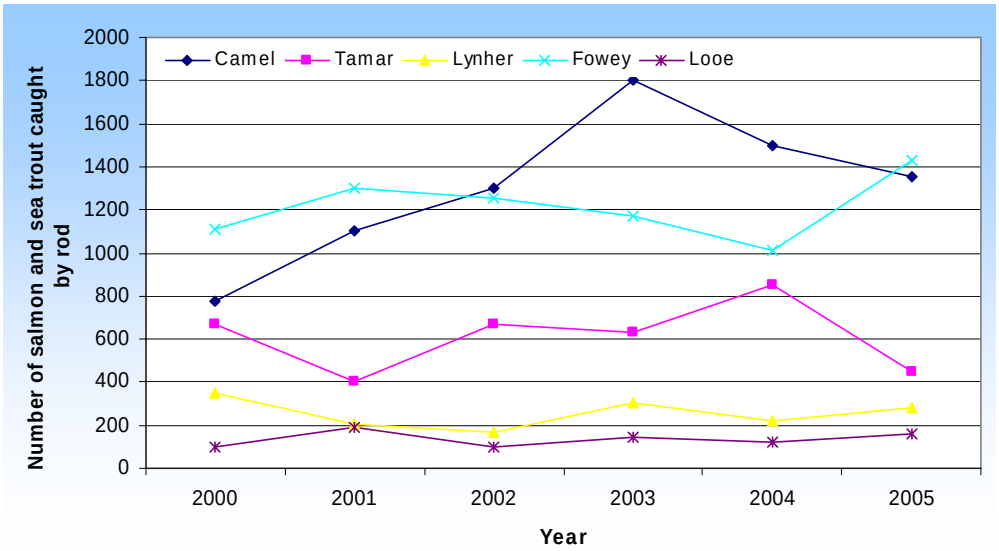
Source – (EA, 2005)

10.6.2. Rod and line caught salmon and sea trout in Cornwall, 1995 – 2005

Given the fact that net fishing for salmon and sea trout on half of the salmonid river fisheries in Cornwall no longer takes place (zero reported hours on the Tamar and Lynher in 2004 and 2005, see Figure 46 net caught salmon and sea trout are no longer a useful indicator of river water quality. An alternative source may be rod and line caught salmonids. Salmon and sea trout caught by rod and line must be reported to the EA by the angler and it is believed that 90% of all migratory salmonids (salmon and sea trout) caught in England and Wales are reported to the EA each year (EA, 2005). This may be a useful alternative to the net caught data if salmon and sea trout numbers are to be used as an indicator of water quality. Figure 47below illustrates the number of rod caught salmon and sea

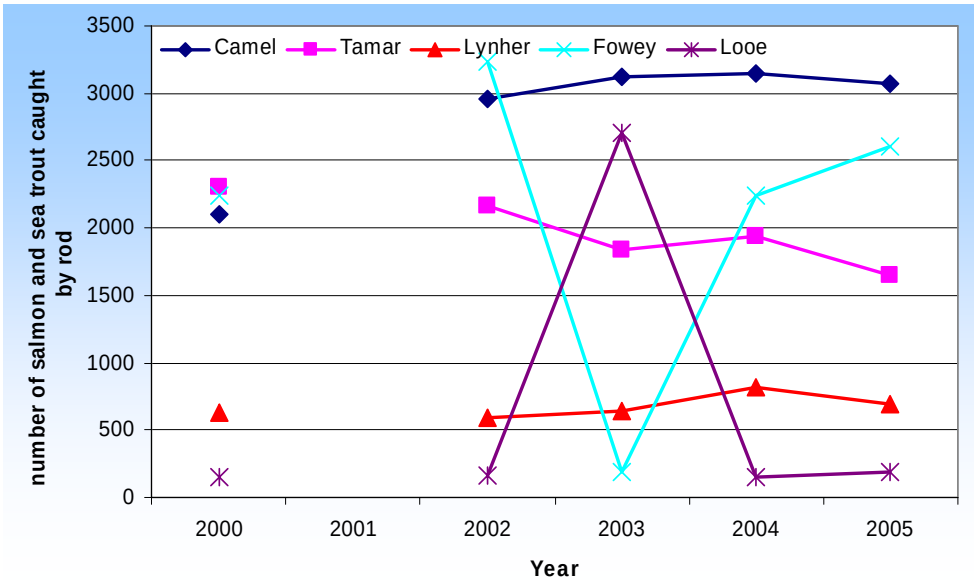
trout in the Cornish salmonid river fisheries between 2000 and 2005. As with the net caught salmonids these data must be compared with the effort or in this case, number of days fished for salmon and sea trout using rod and line (Figure 48).

Figure 47 - Numbers of rod and line caught salmon and sea trout in Cornwall between 2000 and 2005



Source – (EA, 2005)

Figure 48 - Numbers of days fished using rod and line for salmon and sea trout in Cornwall between 2000 and 2005



Source – (EA, 2005)

As with net caught salmonids and the associated effort, the correlation between the number of salmon and sea trout caught by rod and line and the number of days fished is good. The exception to this is in 2003 when the number of days fished on the Fowey reduces significantly yet the number of caught fish reported does not. This may be a lack of effort reported to the EA or it could actually be a particularly good year's fishing in that fewer days were fished for a similar to average catch. What the rod and line caught salmonid data do show is that populations still exist within the cornish salmonid river fisheries, and that rod and line data continues to be a useful source of information.

10.7. Fresh water environment – summary

- Population growth has not resulted in overall degradation of the fresh water environment in Cornwall.
- Some areas of eutrophication have been identified, the result of high concentrations of nitrates and phosphates entering the water.
- Reported catches of salmonids have fallen in the Cornish fisheries, a combination declining stocks and reduced effort.

11. MARINE WATER ENVIRONMENT

Like the freshwater environment in Cornwall and the Isles of Scilly, the marine water environment has economic, aesthetic and environmental properties which are of great importance. Clean, safe, beaches are vital for the tourist industry, and clean unpolluted coastal waters are crucial for the inshore fishing industry. The following sections will review both the primary and the tertiary industries which rely on marine water quality.

11.1.Primary industry

Like the Cornish tin mining industry the fishing industry has declined in the last 30 years. A combination of factors including reducing stocks and changes in fishing methods has seen fleet sizes diminish and almost disappear from some ports where the industry is no longer viable, particularly for smaller, inshore vessels. However, data for fleet sizes, quantity of fish landed and value suggests the situation has stabilised in recent years (see Figure 49).

11.1.1. Fishing industry – summary of catch and value between 1999 – 2005 in Cornwall

The Marine fisheries agency (MFA) produces an annual report on behalf of DEFRA which details statistics for ports around the UK. Table 24 below shows the quantity of fish landed in ports in Cornwall between 1999 and 2005.

Table 24 - Value (£000) of fish landed in ports in Cornwall between 1999 and 2005

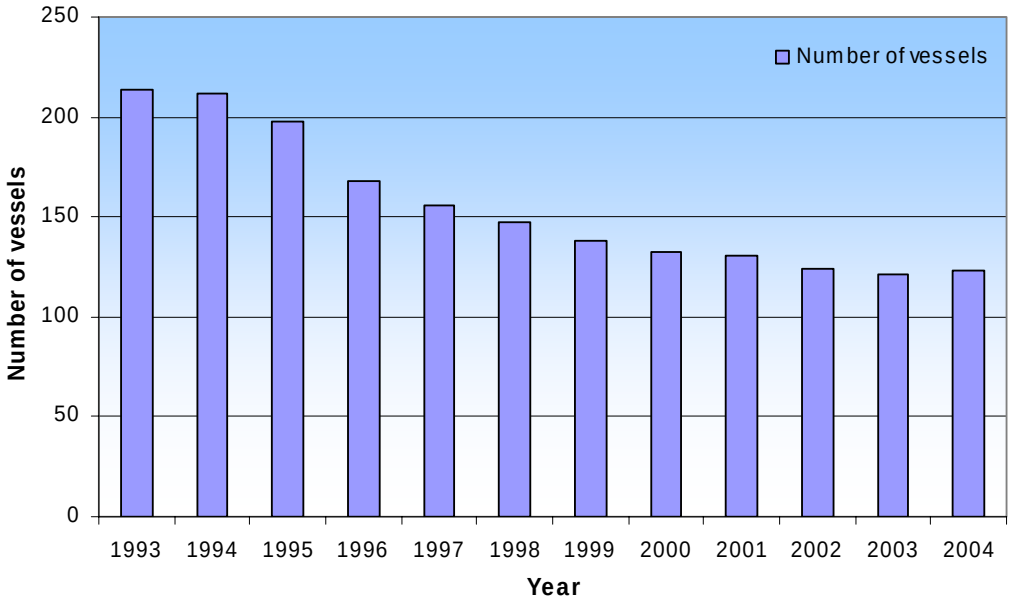
	1999	2000	2001	2002	2003	2004	2005	Average
Total fish (pelagic and demersal)	19,654	18,845	18,826	24,450	19,365	16,434	17,878	19,350
Total shellfish	3,256	4,736	5,591	8,897	5,429	4,894	4,828	5,376

Source – (MFA, 2006)

The data in Table 24 shows the annual average value (combined) of fish and shellfish landed in ports in Cornwall is around £24 million. The figures rose for both fish and shellfish in 2002 but no data is included in the annual report by the MFA to suggest a cause. Overall there has been a 9% decline in the total value of fish landed between 1999 and 2005. During the same period, there was a 26% reduction in the quantity of fish landed. The decoupling of quantity of fish landed (26%) and value of fish landed (9%) may have been caused by rising fish prices as the supply decreases. Table 24 also shows the rise in total shellfish value (48%). During the same period (1993 – 2004) the quantity of shellfish landed increased by 27%. The change in quantity of fish and shellfish landed could be due to a number of factors but the rising price for shellfish (13% increase £ per tonne (live weight) between 2000 and 2004) is likely to be significant contributor and an attractive incentive to switch target species (MFA, 2005)

The MFA annual report also includes details of fishing fleet sizes for the major ports around the UK of which Newlyn is one. Figure 49 below shows the decline in fleet size (vessels over 10 m in length) at Newlyn between 1993 and 2004. The rapid fall in vessel numbers appears to have slowed since 2000 when numbers stabilised around 120.

Figure 49 - Fleet size for vessels over 10 m (length) between 1993 and 2004



Source – (MFA, 2005)

11.1.2. Shellfish waters

The main species of shellfish included in the shellfish data in the previous sections are crabs (*cancer pagurus*), langoustine (*nephrops norvegicus*) and scallops (*pecten maximus)* and are generally caught offshore due to their intolerance to freshwater (MFA, 2005). There is also an inshore shellfish fishery in Cornwall that includes species such as mussels (*Mytilus spp.*) and oysters (*Ostrea edulisl*) which are farmed in many rivers and estuaries around the coast. There are a total of 50 shellfish beds across seven rivers and estuaries in Cornwall all of which must be in waters that comply with both the Shellfish Waters Directive (79/923/EEC) and the Shellfish Hygiene Directive (91/492/EEC) (DEFRA, 2007m).

11.1.2.1. Shellfish waters directive (79/923/EEC)

The Shellfish waters directive sets water quality standards to protect the areas in which shellfish grow and reproduce. Water quality samples are taken by the relevant Local Authority and tested for a number parameters including metals, organohalogens and others including dissolved oxygen, pH and faecal coliforms (DEFRA, 2007m). Failure to meet the water quality standards may result in restriction being placed on the use of the area for shellfish farming.

11.1.2.2. Shellfish hygiene directive (91/429/EEC)

The 91/429/EEC directive monitors areas where shellfish harvesting takes place to ensure the shellfish are fit for human consumption. The areas are graded by the level of treatment the shellfish require before they can be safely consumed. This varies from class A (fit for consumption without treatment) to C where intensive treatment is required (DEFRA, 2007m). Of the 50 areas monitored in Cornwall 42 are in class B and the remaining 8 are in class C indicating poorer water quality than potentially could be achieved (FSA, 2007).

This presents Cornwall with an environmental and economic opportunity. If the water quality can be improved the biodiversity in the affected environment will improve and this includes the growth and production of oysters. If the farmed oysters can be produced to class A standards then not only is a more desirable product produced but the cost of treatment (relevant for class B and C oysters) is removed which will increase profitability.

11.2. Marine Special Area of Conservation

Special Areas of Conservation (SAC) can be declared in terrestrial, coastal and marine environments. The designation offers the area strict protection under the EC Habitat Directive (Council Directive 92/43/EEC). A list of habitats and species that are protected as part of a Marine SAC (MSAC) is available from the Joint nature conservation committee (http://www.jncc.gov.uk/page-1445). Across the UK there are 76 MSACs two of which have been declared in Cornwall and the Isles of Scilly. Table 25 below shows some of the details of the two declarations in Cornwall and the Isles of Scilly.

Table 25 - Marine Special Areas of Conservation in Cornwall and the Isles of Scilly

	Fal and Helford	Isles of Scilly complex
Area (ha)	6387.8	26850.95
Marine areas/Sea inlets.	60%	75%
Tidal rivers/Estuaries/Mud flats/Sand flats. Lagoons (including saltwork basins).	35%	20%
Salt marshes/Salt pastures/Salt steppes.	3%	5%
Coastal sand dunes/Sand beaches/Machair.	1%	

Source – (JNCC, 2007)

11.3.Tertiary industry

The main tertiary industry in Cornwall and the Isles of Scilly which thrives on the quality of the marine environment is the tourist industry. The tourist visitor survey 2004-05, found that approximately 33% of visitors said the sea/beaches/coast was Cornwall's best feature and that this was also the third most popular reason for visiting the county (South West Tourism, 2005). The importance of the quality of bathing water and beaches is hugely significant given that the tourism industry is estimated to be worth £1.64 billion (total visitor spend) (SWRRG, 2001).

11.4. Marine water quality – indicators

Indicators are important to monitor changes within marine water, especially in areas where the public are likely to come into contact with it. Statutory guidelines for water quality are in place to ensure the safety of bathers around the coast of Britain. It is in the interest of coastal tourist hotspots to ensure the water quality is as high as possible. The following sections will look at marine water quality indicators and the results in Cornwall in recent years.

11.4.1. Bathing water quality

The Environment Agency monitors the implementation of the 76/110/EEC bathing water directive around the UK coastline to ensure the safety of bathers (EA, 2007e). There are three categories of bathing water quality; failed, basic (mandatory) and stricter (guideline) quality. Water quality is measured against total coliform and faecal coliform concentration, and additionally faecal streptococci for the guideline standards (EA, 2007e). Beaches with good quality bathing water are of particular economic and environmental value to the South West. The past decade has seen bathing water quality across England and Wales improve with 85% of bathing beaches complying with the mandatory water quality in 2006 compared to 32% in 1990 (EA, 2007f).

11.4.2. Blue Flag awards

Blue Flag awards (http://www.blueflag.org.uk/) are awarded to beaches that meet several criteria including; bathing water quality, facilities, safety, environmental education and management. This is an international scheme and Blue Flag status is a valuable asset to any coastal resort and has been the incentive for many improved beaches in the UK

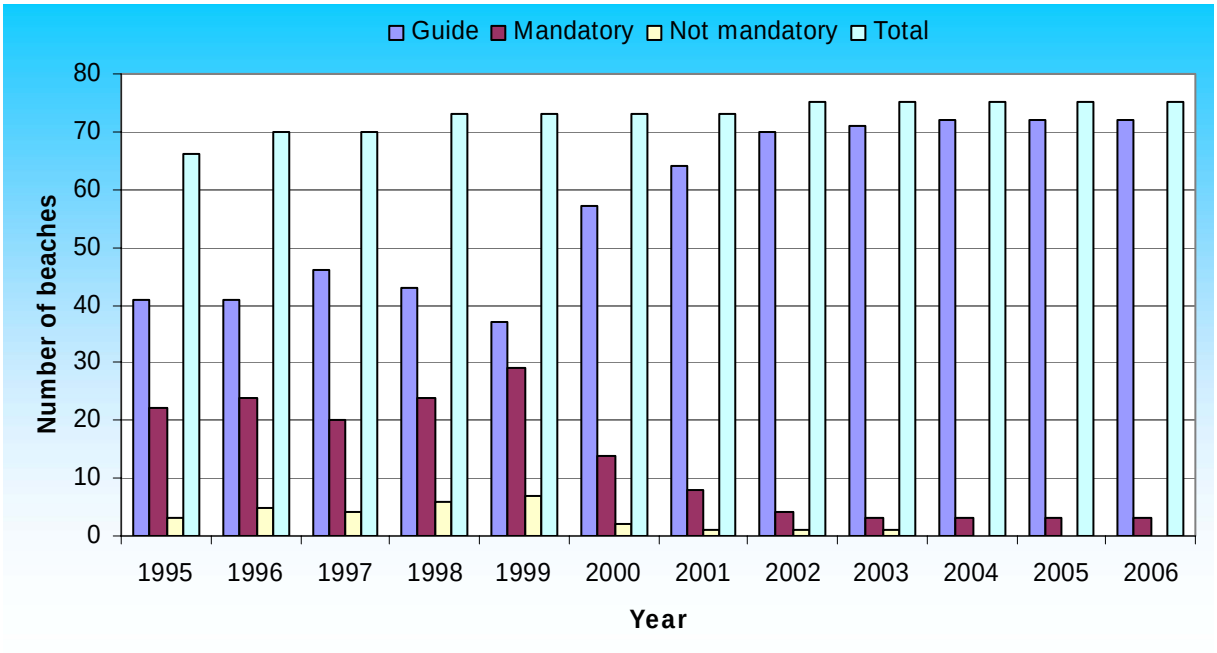
since its inception. In 2007, nine beaches and one marina were awarded the Blue Flag in Cornwall out of 85 awarded across England (ENCAMS, 2007).

Although it wouldn't be possible to attain Blue Flag status on all beaches in Cornwall (the remote nature and inaccessibility instantly ruling several beaches out of the criteria), increasing the number of beaches with Blue Flag status would assist the development of the tourism industry.

11.4.3. Bathing water quality in South West and Cornwall

In 2006 all beaches in the South West met the mandatory standards and 89% met the stricter guideline standards. In Cornwall, 72 of the 75 designated bathing beaches met the guideline standards with the remaining three meeting the mandatory standards and therefore no beaches failed. Figure 50 shows the number of designated bathing beaches in Cornwall and their compliance with the 76/110/EEC bathing water directive between 1995 and 2006.

Figure 50 - Number of designated bathing beaches in Cornwall and their compliance with the 76/110/EEC bathing water directive grades between 1995 and 2006

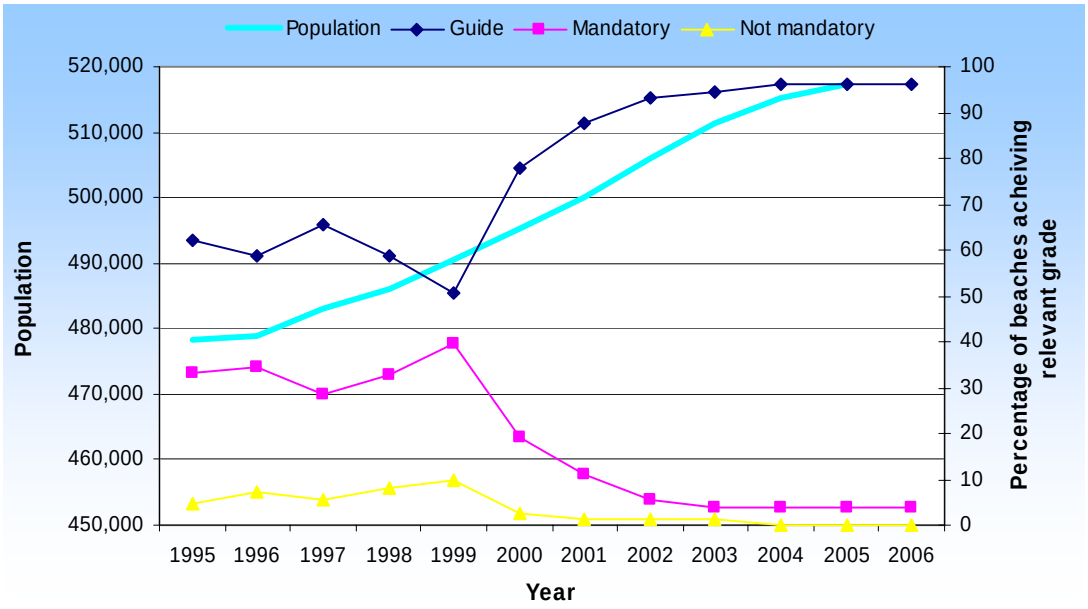


Source – (EEA, 2007a)

11.4.4. Bathing water quality in Cornwall and population growth

Prior to the introduction of the 76/110/EEC Bathing Water Directive in 1976, sewage disposal in coastal water was almost unchecked in that sewage could be disposed to sea with little or no treatment. Following the introduction of the directive, coastal water quality has been improving despite the increasing demands of a growing population. Figure 51 below shows the population growth and the number of beaches achieving the bathing water quality grades set out in the 76/110/EEC directive.

Figure 51 - Grades achieved by beaches in Cornwall versus population, between 1995 – 2006



Source – (Miller, 2006), (EEA, 2007a)

Figure 51 shows the unquestionable improvements in the bathing water quality on beaches around the Cornish coast despite the population rise. This shows how technology can at present cope with the demands of the local population and the tourist population. However, consideration must be given to the growing demand for an increase in the tourist industry in Cornwall and the consequences this may have. In a tourist town in South Devon sewage incidents occurred in consecutive years during the busiest weeks of the year forcing beaches to close for bathing (BBC, 2005b and BBC, 2006a). It could be that the sewage treatment works in Dawlish cannot cope with the demand of the peak-week. Planning must be in place to avoid a similar situation in Cornwall.

11.4.5. Bathing water quality in South West and Cornwall – the impact of climate change?

In 2007 bathing water around the South West regions coast fell from the previous year's 100% pass record to 98.4%. Not a huge drop but a drop nonetheless and one which the Environment Agency have attributed to the heavy rainfall experienced during the 2007 summer.

'We saw an extraordinary amount of rainfall during the summer and this caused a temporary increase in the amount of pollution at some bathing waters because of run-off from farmland and storm overflows in the sewerage system,' said Environment Agency Chief Executive Barbara Young (EA, 2007h)

Although the IPCC are forecasting warmer, drier summers they are also forecasting heavy precipitation events (IPCC, 2007) which could see flash floods causing more run-off from land and overloading of sewage plants resulting in bathing water failing to meet the statutory quality more frequently.

11.5. Beachwatch litter surveys

The Marine Conservation Society (MCS) holds an annual event it calls Beachwatch. The volunteer based event takes place once a year and participants collect and record litter on beaches around the UK. The litter collected is separated into different categories before being attributed to various sources e.g. beach visitors, fishing etc (MCS, 2007). The survey is a useful indicator for identifying the impact of various sources on the coastal environment which in counties such as Cornwall, where beaches are a major part of the tourist attraction, is very important. The data analysis is summarised by region so Cornwall specific results cannot be taken from the annual report.

However, even at regional level the impact of beach visitors can be seen. Table 25 below shows the four regions in England included in the survey and the items of rubbish identified per kilometre.

Table 26 - Beachwatch 2006 litter survey – items of litter per kilometre for regions in England

Region	Items / km 2004	Items / km 2005	Items / km 2006	Volunteers / km 2006
NE England	1,102	1,232	1,621	19
NW England	2,949	1,579	1,927	32
SE England	1,791	1,847	1,604	17
SW England	4,277	3,936	3,186	34
England (Total)	2,243	2,256	1,980	22

Source – (MCS, 2007)

The data in Table 26 shows the items of rubbish per kilometre have been highest in the south west region by a considerable margin between 2004 and 2006. This could be caused by a number of reasons but as the number of volunteers per kilometre of beach shows the effort in the south west region was very similar to that in the north west region yet the items per kilometre was more than 1,000 items more. The most probable reason for the higher numbers of items of rubbish collected in the south west region is its popularity as a tourist destination and therefore the number of beach users can be expected to be considerably higher than the other regions.

Table 27 - Beachwatch 2006 litter survey - sources of litter in regions in England

	Beach visitors	**Fishing**	**SRD**	**Shipping**	**Fly-tipped**	**Medical**	**Non-sourced**
	Items/km	**Items/km**	**Items/km**	**Items/km**	**Items/km**	**Items/km**	**Items/km**
NE	666	111	92	29	15	2	704
NW	808	169	131	66	23	4	725
SE	598	156	61	30	12	2	745
SW	988	499	153	50	44	5	1447
UK average	673	223	206	40	18	3	825

Source – (MCS, 2007)

Table 27 shows the greatest density of litter i.e. items per kilometre can be attributed to beach visitors, in every region of England. The second greatest source of litter is the fishing industry (commercial and recreational). This shows the impact of human activity on this environment and this will not only harm the biodiversity and habitat but it will also detract from the aesthetic appeal of the locations which in areas such as Cornwall will have a negative impact on the tourist industry and therefore the economy in the surrounding area.

11.6. Marine water environment – summary

- Under 10m vessel fleet size has reduced since 1993 but stabilised around 2000. The reduction is though to be due to declining fish stocks amongst other issues.
- Bathing water quality has improved and despite population growth. The value of the environmental asset has been recognised in the Tourism Survey report.
- Inshore shellfish fishery water quality is either Class-B or Class-C. Improving water quality would improve the fishery value and the local aquatic environment.
- The increased demand on the sewerage system brought about by population growth needs to be addressed to ensure good coastal water quality in the future.

12. DEMOGRAPHICS

Understanding Cornwall's demographics is a key way of gaining insight into future changes in the economy, culture and impacts on the environment. Growth in population will increase demand for all services, products, education etc. However, that growth contains an aging population which will put increasing demand on pensions and health care. Being able to forecast this situation means that the necessary resources and skills can be put in place to meet the demand and, in some cases, benefit from it. As more data becomes available it may also be possible to accurately forecast the environmental impacts of various demographic groups. In the report, "Greening the Greys" by Haq *et al.* (2007), the carbon footprint of various demographic groups in the UK are calculated. The report finds that the average UK citizen has a carbon footprint of 11.8 tonnes whilst the average "baby boomer" (aged 50 – 64) has a carbon footprint of 13.5 tonnes (see Section 2.7). The implications of these data will be discussed in more detail later in the report but there will no doubt be impacts on the UK's bid to reduce carbon emissions.

12.1. Population – UK, the South West and Cornwall and the Isles of Scilly

12.1.1. Historical population growth - UK, the South West and Cornwall and the Isles of Scilly

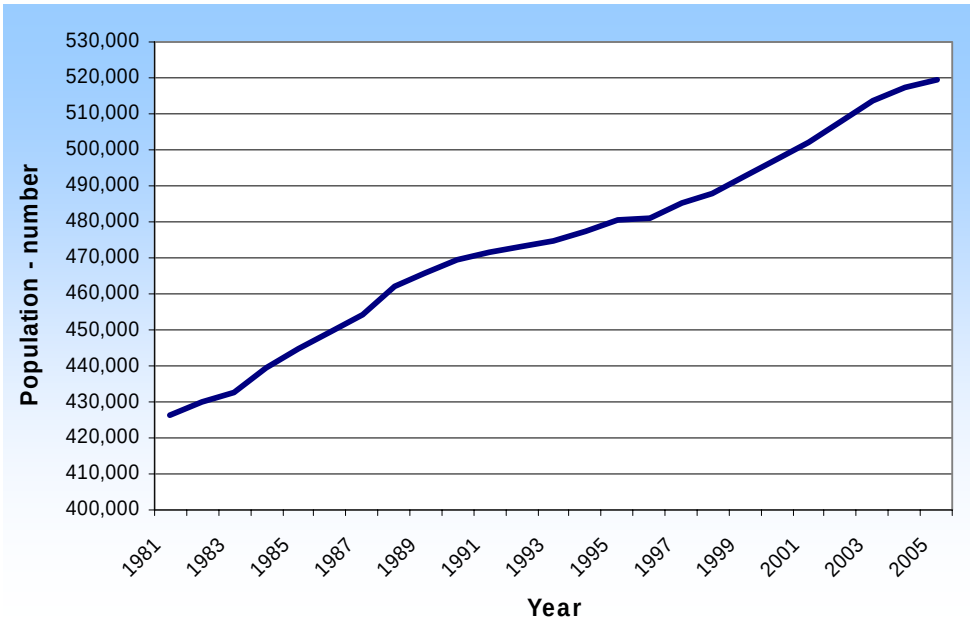
Between 1971 and 2001 the UK has experienced continued population growth and the projections are for further increases (ONS, 2005a). Population increase has not been uniform across the UK with both the South West and Cornwall and the Isles of Scilly experiencing growth rates higher than the national average (Table 28). Figure 52 plots the net population growth in Cornwall between 1981 and 2005 taking into account live births and deaths as well as migration.

Table 28 - Population increase in the UK, South West and Cornwall & IoS between 1971 and 2001

Population increase: 1971 - 2001					
Thousands					
	Year				
	1971	1981	1991	2001	growth %
UK	55,928	56,357	57,439	59,113	5.7
South West	4,112	4,383	4,688	4,943	20.2
Cornwall & IoS	382	426	472	502	31.4

Source – (ONS, 2005a - *Reproduced under the terms of the Click-Use license*)

Figure 52 - Population growth in Cornwall between 1981 and 2005



Source – (Miller, 2006)

12.1.2. Projected population growth - UK, the South West and Cornwall and the Isles of Scilly

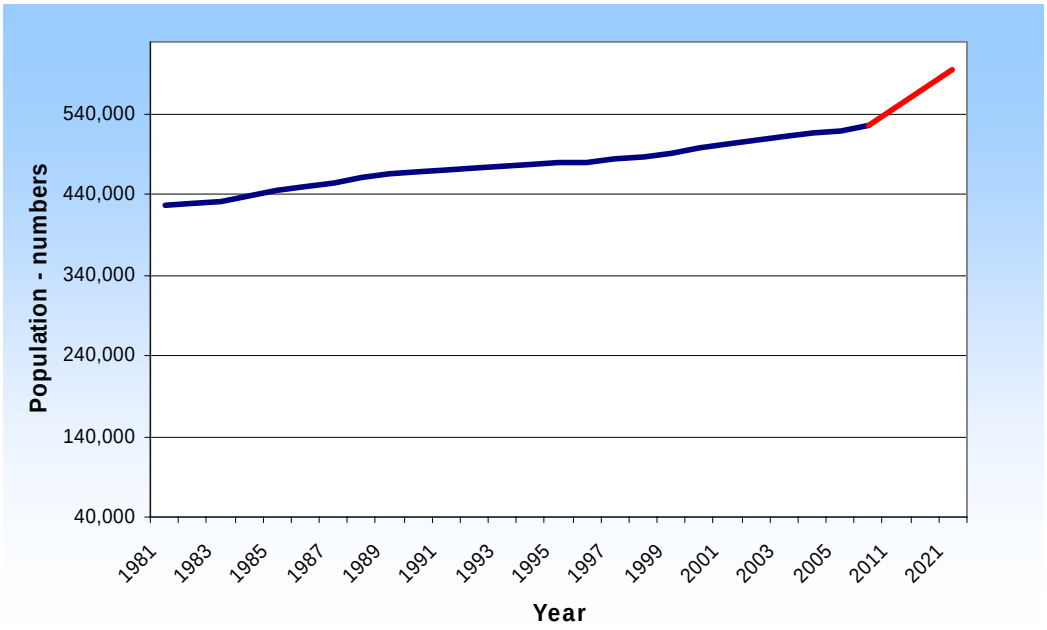
Although the national population projections between 2006 and 2021 are slightly higher than the historical growth (between 1971 and 2001), the South West and Cornwall & IoS projections are lower than the recent growth rates but still above the national average (Table 29 and Figure 53).

Table 29 - Population projections for the UK, South West and Cornwall & IoS

Population projection: 2006 - 2021					
Thousands					
	Year				
	2006	2011	2016	2021	growth %
UK	60,254	61,401	62,618	63,835	5.9
South West	5,097	5,262	5,429	5,601	9.9
Cornwall & IoS	527	550	573	596	13.1

Source – (ONS, 2005a - *Reproduced under the terms of the Click-Use license*)

Figure 53 - Population growth in Cornwall between 1981 and 2005 with projected growth to 2021



Source – (ONS, 2005a - *Reproduced under the terms of the Click-Use license*)

12.2. Components of population change in Cornwall and the Isles of Scilly

Population change in its most basic form is caused by a change in the ratio of live birth to death rates and/or migration into or out of an area. Between 1993 and 2003 death rates in Cornwall & IoS outnumbered the live births by a ratio of 1:1.2 (live births : deaths). This resulted in a natural change (loss) figure of ~12000 for the period between 1993 and 2003. However, the inward migration of 513500 to Cornwall and the Isles of Scilly during the same period resulted in a net migration of 38800, an 8.2% population growth (Table 30).

Table 30 - Components of population change in Cornwall and the Isles of Scilly between 1993 and 2003

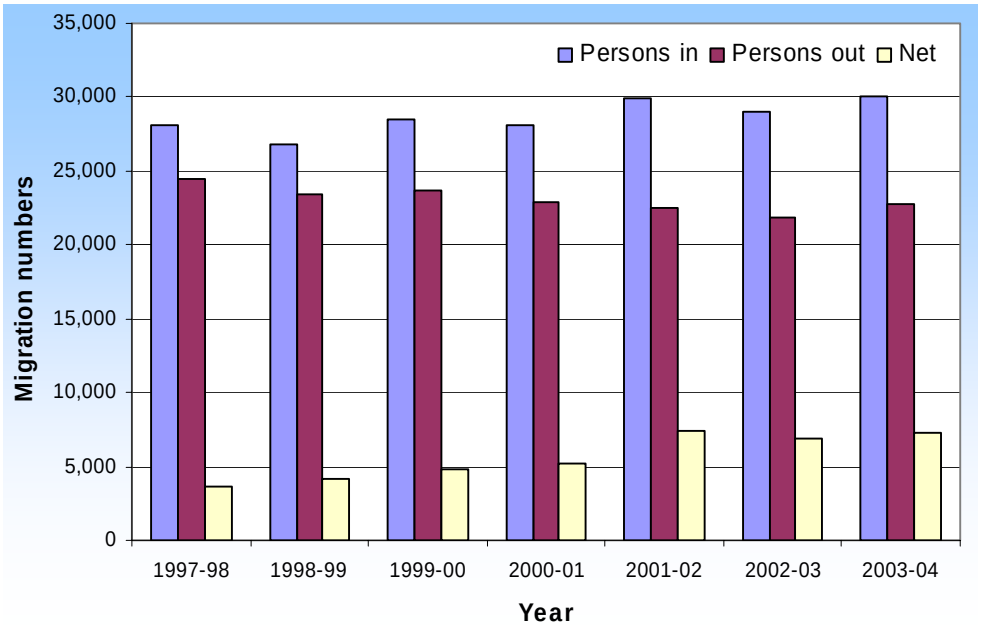
	Resident population mid - 1993	Births	Deaths	Net natural change	Net migration and other changes	Resident population mid 2003	Population growth (%)
Cornwall & IoS	474700	48800	60700	-12000	50700	513500	8.2

Source – (ONS, 2005a - *Reproduced under the terms of the Click-Use license*)

12.3. Migration in Cornwall and the Isles of Scilly

As mentioned in Section 12.2, the growth of Cornwall's population in recent years has been due entirely to inward migration. Figure 54 plots the inward and outward migration figures between 1997/08 and 2003/04. The rate of net migration fluctuated during this period but the overall trend has been an increasing inward migration and decreasing outward migration which has the combined effect of accelerating the net migration increase.

Figure 54 - Migration patterns into Cornwall and Isles of Scilly between 1997/08 and 2003/04.

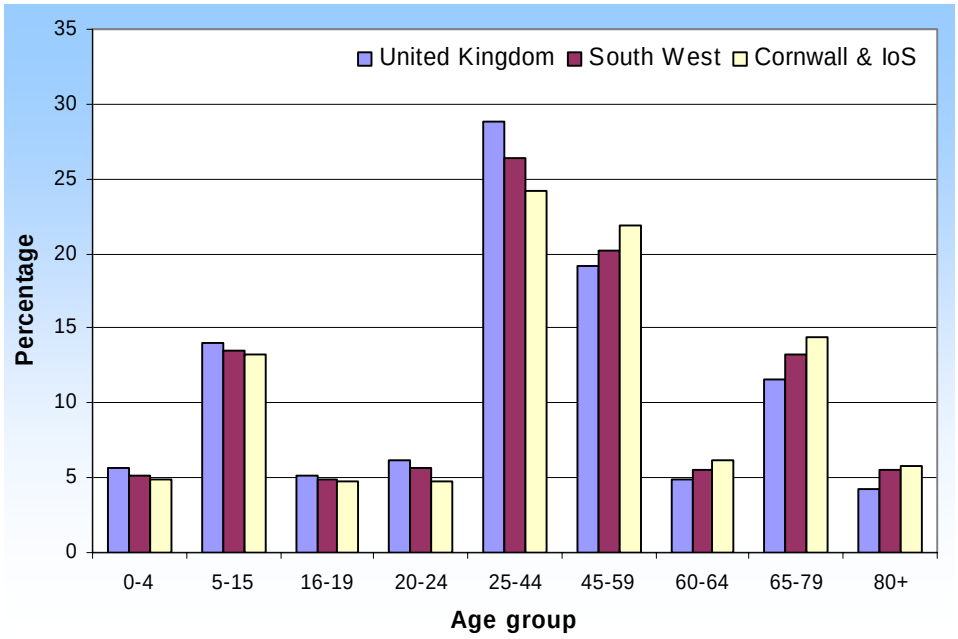


Source – (Miller, 2006)

12.4. Population age groups in the UK, South West, Cornwall and the Isles of Scilly

The age profile of the population varies in each region and this can have a number of effects on the economy and productivity of an area. This generally depends on the ratio between dependent and economically active age groups. Cornwall and the Isles of Scilly have a higher than average percentage population above the age of 45 (Figure 55).

Figure 55 - Age profile of the population in the UK, South West and Cornwall & Isles of Scilly.

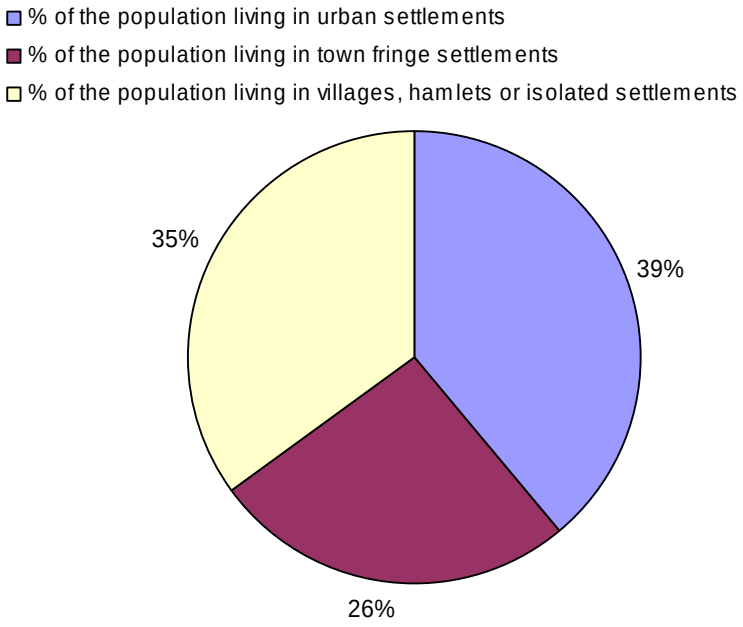


Source – (ONS, 2005a - *Reproduced under the terms of the Click-Use license*)

12.5. Population distribution – Cornwall and Isles of Scilly

In the Isles of Scilly, 100% of the population lives in locations classified as villages, hamlets and isolated settlements. This has numerous advantages and disadvantages regarding access to services, economy, quality of life etc. Figure 56 below shows the distribution of the population in Cornwall. There is a slight majority (39%) living in urban settlements with 35% living in villages, hamlets and isolated settlements. The remaining 26% live in town fringe settlements.

Figure 56 - Population distribution in Cornwall



Source – (Audit Commission, 2007)

Approximately two-thirds of the proposed housing developments in Cornwall between 2001 and 2016 are to be built around the major urban settlements e.g. Camborne-Pool-Redruth, St Austell and Newquay (CCC, 2004). This will require additional land and will result in the loss of various habitats, good and services.

12.6. Demographics – summary

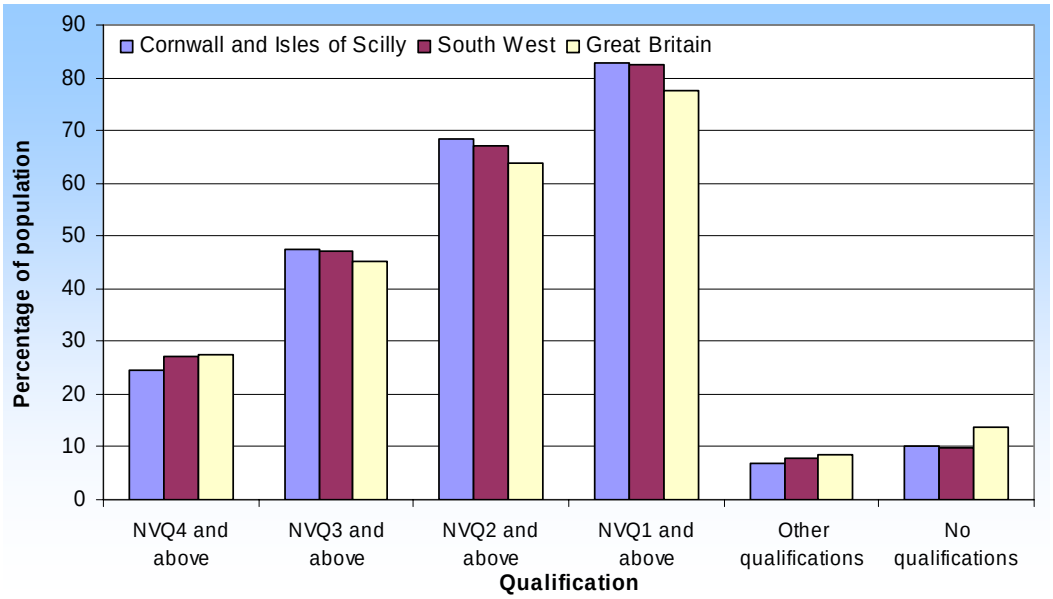
- Population growth in Cornwall is faster than the national average.
- Population growth (at present) is due entirely to in-migration.
- Cornwall has an aging demographic which as discussed else where in the report will have increased impacts on areas such as energy use and carbon emissions.

13. EDUCATIONS AND SKILLS

To enable Cornwall and the Isles of Scilly to adjust to its changing economic situation and the move from primary industries to tertiary industries such as services, education and the many roles within tourism, there needs to be a skilled workforce in place. In line with national and regional trends the percentage of the population in Cornwall and the Isles of Scilly gaining qualifications has been increasing. In 2006, the percentage of population with NQV Level 1-3 qualifications was higher in Cornwall and the Isles of Scilly than the national and regional average (Figure 57 below). The growth in numbers gaining NQV Level 1 and 2 has far exceeded the national average in the period between 2000 and 2006 (ONS, 2006a - *Reproduced under the terms of the Click-Use license*). The development of the Combined Universities in Cornwall (CUC) the provision for delivering NVQ Level 4 qualifications (e.g. HND, Degrees etc) is increasing and the current growth in numbers gaining Level 4 qualifications can be expected to rise.

Miller (2006) identified a reduction in the number of people aged 18 leaving the county between 2000 (1121) and 2005 (920). This may already be a sign that the resident population seeking Higher Education (NVQ Level 4) are staying the County.

Figure 57 - Percentage of population and qualification in Great Britain, the South West, and Cornwall and the Isles of Scilly.



Source – (ONS, 2006a *Reproduced under the terms of the Click-Use license*)

13.1. Education and skills – summary

- The percentage of the population in Cornwall with NVQ level 1 – 3 is higher than the GB average.
- Higher education provisions in Cornwall are increasing. Migration trends within the County suggest this is already having an impact on retaining people around the age of 18.
- The higher education provisions in Cornwall should be used to develop and knowledge base and provide the workforce required for the development of Cornwall.

The percentage of the population in Cornwall and the Isles of Scilly with and NVQ level 1 – 3 (equivalent) is equal to or greater than the national average and, the percentage gaining NVQ level 4 and above (degree and above) is increasing (3% lower than the national and regional average (ONS, 2006a)). The provisions for attaining these qualifications in the County have grown in recent years with the development of Higher Education institutes. Migration statistics suggest the higher education facilities in the County are attracting residents to stay and gain higher education rather than seek it elsewhere. This is important for several reasons. First, residents in Cornwall are capitalising on and benefiting from the resources which help develop the knowledge base and economy of the County. Second, a growing knowledge base is needed if new opportunities in fields such as renewable energy are to be developed. It will be better, developmentally and initially cheaper if the demand for skilled labour can largely be met from sources within Cornwall.

14. QUALITY OF LIFE

Quality of life perceptions provide a useful measure of community's opinions of the environment around them. A recent survey undertaken by the Local Intelligence Network in Cornwall (LINC) on behalf of the Cornwall Strategic Partnership examined attitudes in the County. Surveys were sent to all 16 of the community network areas in Cornwall and a total of 3,222 responses were received. The Survey covers a wide range of issues and the full report is available to download from the LINC web site at

http://www.cornwallstatistics.org.uk/index.cfm?articleid=37090. This report focuses on the questions and responses which relate directly to the environment. Table 31 below includes the relevant question and the salient points of the responses.

*The 16 Community Network Areas in Cornwall include:
Bodmin
Bude
Camborne/Redruth
Camelford
Falmouth/Penryn
Fowey/Lostwithiel
Helston/The Lizard
Launceston/Liskeard
Newquay
Penzance
Saltash/Torpoint
St Austell
St Ives/Hayle
Truro
Wadebridge/Padstow

Table 31 - Quality of life survey 2007, summary of questions directly related to the environment

Quality of life survey question	Response summary
Thinking generally, which of the things below would you say are most important in making somewhere a good place to live?	**Access to the natural environment** was the third highest priority for 44.1% of respondents. This was a significant increase from 24.9% in 2006
To what extent do you agree or disagree with the following statements	94.9% agreed or strongly agreed that **being out in the natural environment is good for my health.**
Which of the following factors are important in making you feel that you belong to your community?	50.6% felt it was the **Landscape / Environment**
How big a problem do you think the following environmental issues are in your neighbourhood?	**Traffic congestion** was cited as a problem by 45.8% whilst 11.3% said **local air pollution** was a problem.
For what reason(s), if any, is the natural environment important to you?	The most important reason for the environment according to the survey was, "**For the wildlife**" (85.3%), only 1.4% said, "**It isn't important to me**".
What do you consider to be the greatest threat to the natural environment in Cornwall?	**Traffic volume**, is the greatest (67.8%) perceived threat to the environment in Cornwall followed by **housing development** (63.0%); 35.8% suggest **climate change** as the biggest threat.
In your opinion is the Cornish environment getting better or worse?	38.2% thought the Cornish environment was **getting worse** and 11.8% thought it was **getting better.**

Source - LINC, 2007

The questions and responses in Table 31 show the natural environment in Cornwall is clearly important to communities with nearly 95% agreeing that being in the natural environment was good for their health and 51% felt the landscape/environment made them feel part of the community. Traffic volume/congestion is cited twice as being a threat to the Cornish environment as is housing development. Only 35.8% of the respondents thought climate change was a threat to the Cornish environment which highlights the difficulty facing any effort that involves support from the community when trying to tackle and mitigate this global problem. Overall, 38.2% thought the Cornish environment was getting worse and just 11.8% thought it was getting better.

The results from these surveys have to be analysed over a long period of time. Their subjective nature means responses are difficult to interpret. The results could be used as a measure of success with regard to the Sustainable Community Strategy.

14.1. Quality of life – summary

- Quality of life survey data in very important for identifying and assessing opinions in the County. The data can help identify the success of changes implanted in the County.
- The Quality of Life survey results clearly indicate the importance of the environment for residents in Cornwall. It also highlights the issues that are considered a threat to the Cornish environment.

- It is important that these surveys are performed regularly to keep in touch with communities, particularly during the period when the County Council becomes a Unitary Authority and the Sustainable Community Strategy is delivered.

15. HOUSING

15.1.National demand

As the national population increases (Section 12.1) so therefore does the demand for housing. However, the correlation between housing demand and population growth is not linear and there are several other factors which contribute to an accelerating housing demand. Shifts in national demographics will see an increasing adult population between 2003 and 2026 which will be responsible for 123,000 of the 209,000 additional households in the UK per year. Decreasing household size (number of people living within the household) is forecast to increase by 150,000 per year.

15.2. Demand within Cornwall (applicable to the Isles of Scilly)

The housing demand in Cornwall is different to the national situation due to several external pressures altering typical market patterns. Like the national population, the population of Cornwall and the Isles of Scilly is growing - albeit at a faster rate than nationally, 13.1% in Cornwall and the Isles of Scilly against 5.9% nationally between 2006 and 2026. In addition to this, high house prices, low wages and a demand for second homes in Cornwall from outside the County have made getting on the "property ladder" in Cornwall particularly difficult. In August 2007, Carrick in Cornwall was deemed the "least affordable rural area", in a report by the Halifax (BBC, 2007b). The following sections will look at the factors contributing to the increased demand.

15.2.1. Increasing population

The population in Cornwall has grown by 31.4% since 1971 and is projected to grow a further 13.1% between 2006 and 2026. This is due to in-migration as the "resident" population is actually decreasing since deaths currently outnumber live births.

15.2.2. House prices

Nationally, house prices at least doubled across the UK between 1996 and 2006. Cornwall however, has seen an increase in average house price of 268% for the same period. The economy and average wage in Cornwall have not matched this dramatic increase. The cause of the rapid increases in Cornwall has been the subject of much debate but several key factors would appear to be responsible including; housing stock, location and demand discussed in more detail below.

15.2.3. House prices - housing stock structure

The majority of the housing stock in Cornwall and the Isles of Scilly is detached property followed by semi-detached and terraced (Table 32). Table 33 details the average price for each property category which clearly shows detached properties are by far the most expensive therefore putting 38.7% of Cornwall's housing stock into the most expensive category with an average price of £306,744. The average gross annual pay in Cornwall in 2005 was £14,768 (Audit Commission, 2007) making affording the largest sector of the housing stock (detached property) extremely difficult if not impossible.

Table 32 - Housing stock structure in England and Wales, the South West and Cornwall and the Isles of Scilly

2001	England and Wales	South West	Cornwall and IoS
Detached	22.77	30.91	38.67
Semi-detached	31.58	27.94	24.29
Terraced	26.04	23.84	23.41
Flat, maisonette or apartment	19.2	16.48	12
Caravan or other mobile or temporary structure	0.42	0.82	1.63

Source – (ONS, 2005a - *Reproduced under the terms of the Click-Use license*)

Table 33 - Average house price by category in the UK, the South West and Cornwall

Oct-Dec06	UK	South West	Cornwall
Detached	£313,144	£318,152	£306,744
Semi-detached	£187,717	£197,795	£196,735
Terraced	£163,749	£174,658	£176,942
Flat/Maisonette	£189,695	£156,313	£161,792
All	£207,573	£219,999	£226,494

Source – (Land Registry, 2006)

15.2.4. House prices – Location of housing stock

It is estimated that nearly 70% of dwellings in Cornwall are within 3 miles of the coast (including estuaries). This is a desirable quality for which people are willing to pay more. A recent report by the Halifax Estate Agents, revealed that property house prices in coastal towns were on average 3% more than the average property in a coastal county (BBC, 2007c). The location of the coastal housing stock is very attractive for second home buyers and people retiring which in turn forces prices even higher; increasing demand on the smaller stock of semi-detached and terraced properties in Cornwall.

15.3. Housing supply – development proposals in Cornwall

The South West Regional Planning Guidance (RPG10 - http://www.southwest-ra.gov.uk/media/SWRA/Transport/RPG10Fulltext.pdf) includes plans for 40,000 new homes to be built in Cornwall between 1996 – 2016. In 2001, 10,360 of these properties had been completed which leaves 29,600 to be built between 2001 – 2016 (CCC, 2004). The rate of development should meet with the demand in the County which stems primarily from the growing population. The new properties will also provide affordable homes making it feasible for young residents in Cornwall to buy in the County.

The new developments will take place on a variety of land classifications (e.g. previously developed land, brownfield sites (40%),) but there will also be some development on greenfield sites (CCC, 2004). Using an average for house size (235 m^2, (Orme, 2006)) an approximate area of land to be developed can be calculated. However, without the data it is impossible to predict the percentage of the developed area which will be greenfield land. Using the average property land area of 235 m^2 and the total number of homes in the RPG10 proposal between 1996 – 2016 (40,000), the area of land to be developed in Cornwall is approximately 9.4 km^2.

15.4. Housing – summary

- Demand for housing is increasing; the result of a growing population, changes in demographics and the attraction of the County as a holiday home destination.
- Home ownership, is very difficult for, those many residents in Cornwall who have low income.
- Plans for 40,000 new homes in Cornwall between 1996 and 2016 will require significant areas of land. Habitat and environmental services will be lost as a result of this development.
- Develop must be undertaken with minimal environmental impact in mind. Investing in best available technology now will reduce the cost of retrofitting in the future.

16. ECONOMY

From fossil fuel extraction to waste generation, modern day practices within a growing economy can have profound impacts on the environment. The UK Environmental Accounts (prepared by the Office for National Statistics) separates economic impacts on the environment into three categories; natural resources, physical flows and monetary. Table 34 below looks at these in more detail.

Table 34 - Economic impacts on the environment - UK environmental accounts categories

Category	
Natural resources	• Oil and gas extraction and reserves - providing information in physical and monetary terms
	• Land cover - reporting on the amount and condition of habitats and landscapes in Great Britain
	• Forestry - providing information on woodland area, diversity and consumption of wood products in Great Britain
	• Fishing - giving information on selected catches and stocks in three sea regions
Physical	• Fossil fuel and energy consumption - a breakdown of fossil fuel use and energy consumption by industry
	• Atmospheric emissions - a breakdown of greenhouse gas and acid rain precursor emissions by industry
	• Material flows - presents information on the total mass of natural resources and products that are used by the UK
	• Waste - estimating the total waste arising in the UK, including information on radioactive waste
	• Water - showing amounts of ground water and non-tidal surface water used by UK industry
Monetary	• Environmental taxes - information on government revenue from environmental taxes
	• Environmental protection expenditure - a breakdown of environmental protection expenditure by general government and UK industry

Source – (ONS, 2007a - *Reproduced under the terms of the Click-Use license)*

To maintain the strength of the economy and the continued development of the country, several actions must be taken;

- improve the efficiency of resource use therefore reducing resource demand
- identify alternative/sustainable/renewable energy sources
- reduce emissions in particular carbon dioxide
- minimise waste generation

Some measures to reduce environmental impact are already in place in the form of environmental taxes.

> *"An environmental tax is defined as a tax whose base is a physical unit such as a litre of petrol, or a proxy for it, for instance a passenger flight, that has a proven specific negative impact on the environment. By convention, in addition to pollution related taxes, all energy and transport taxes are classified as environmental taxes"* (ONS, 2007a).

Recent examples of this include the tax on road vehicles, the climate change levy and the well publicised air passenger duty.

As Cornwall and the Isles of Scilly strive to improve their economy an effective response to the issues listed above would be particularly prudent. There are opportunities to learn from the mistakes which have been made elsewhere and also to utilise and benefit from new technologies. The following Sections will look at how the economy in Cornwall and the Isles of Scilly has changed in recent years and later in the report further discussion will include how Cornwall and the Isles of Scilly can grow without having detrimental effects on the environment on which Cornwall and the Isles of Scilly rely.

16.1. The economy in Cornwall and the Isles of Scilly

Following the decline of the tin mining industry in Cornwall in the 1980s the County's economy has been one of the poorest in the UK in terms of GVA. The fall in prices of tin made this industry no longer viable and during the 80s and 90s the mines around Cornwall closed, marking the end of a lucrative and prosperous era. Since then the county of Cornwall has ranked as one of the poorest economies in the UK. The detail of the economy in Cornwall will be looked at in the following sections.

16.1.1. The economy in Cornwall and the Isles of Scilly – Gross Value Added (GVA)

Gross Value Added (GVA) is an indicator of the economy as a whole but GVA is also used to identify and measure the contribution from individual businesses, sectors and regions to the economy. GVA data are used to estimate Gross Domestic Product (GDP), another key indicator of the UK economy (ONS, 2002).

Collectively, Cornwall and the Isles of Scilly contributed 0.55% (£5,741million) to the national economy in 2004. This was 7.1% of the contribution from the South West region despite Cornwall and the Isles having 10.3% of the population in the South West region.

The latest "First Release" report published by the ONS in December 2006 shows Cornwall and the Isles of Scilly have the lowest GVA per head in the UK (2004) at £11,100. As an index, if the UK equals 100, Cornwall and the Isles of Scilly equal 65. This is significantly lower than the Regional Index for the South West which is 94. The figures for other counties in the South West suggest that geographical location has an impact on GVA and economic performance. GVA figures reduce significantly in each county the further west in the South West Region they are (see Table 35 below).

Table 35 - GVA Index in the South West region

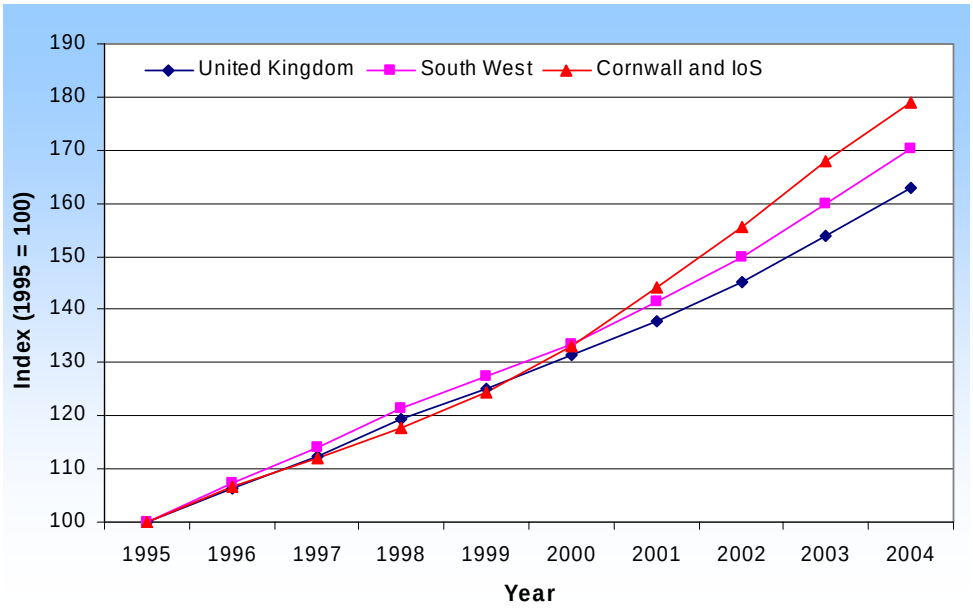
NUTS2 Area	Index (UK = 100)
Gloucestershire, Wiltshire, and North Somerset	117
Dorset and Somerset	81
Devon	77
Cornwall and the Isles of Scilly	65

Source – (ONS, 2006b - *Reproduced under the terms of the Click-Use license*)

16.1.2. The economy in Cornwall and the Isles of Scilly – Gross Value Added (GVA) Growth

Despite the poor performance of the economy in Cornwall and the Isles of Scilly, the situation is improving. The growth of the economy (Total GVA) has been faster than the South West regional and national rate since 1999. Between 1999 and 2004 Cornwall and the Isles of Scilly achieved an average of 7.2% annual growth against 5.8% for the region and 5.4% nationally. Figure 58 below illustrates the growth of GVA as an index in the UK, the South West and Cornwall and the Isles of Scilly. The increased growth between 1999 and 2004 is clear.

Figure 58 - GVA growth index (1995 = 100) in the UK, South West and Cornwall and the Isles of Scilly.

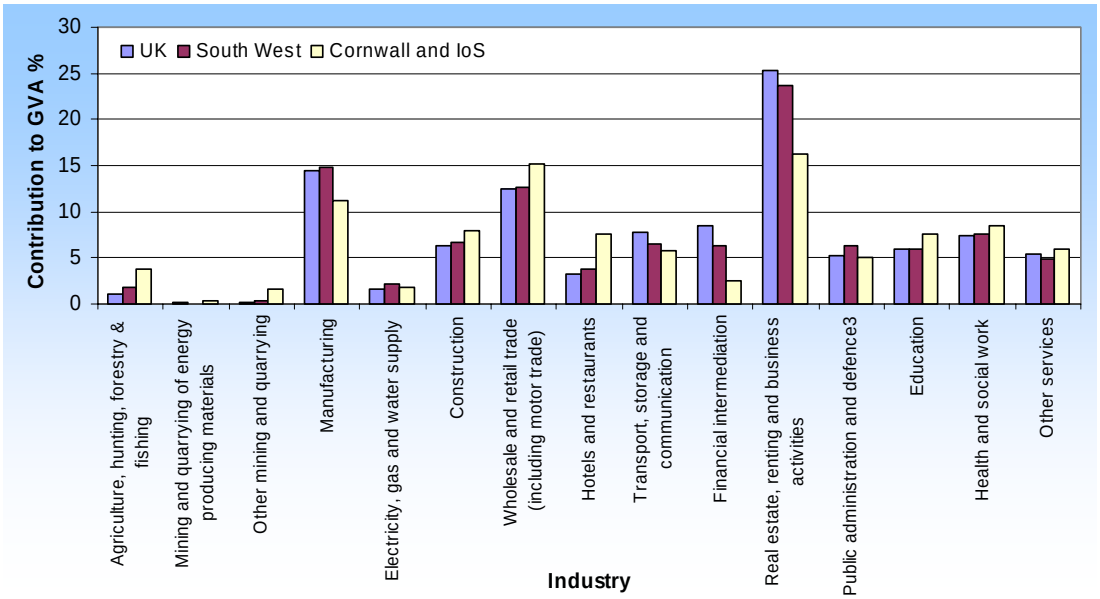


Source – (ONS, 2006b - *Reproduced under the terms of the Click-Use license*)

16.1.3. The economy in Cornwall and the Isles of Scilly – Gross Value Added (GVA): the contribution by sectors

The contribution to GVA varies significantly between sectors. The availability of resources has shaped industry in the UK but the economy has altered the demand for resources and services and hence the various patterns of growth and decline. Typically it has been primary industries like fishing, agriculture and extraction which have declined due largely to the costs of operation against the cost of importing the same product. These changes have not been uniform across the UK with trends in Cornwall and the Isles of Scilly different to even the South West regional changes. Figure 59 shows the contribution to GVA from 15 industries in the UK, South West and Cornwall and the Isles of Scilly.

Figure 59 - GVA contribution from 15 industries in the UK, South West and Cornwall and Isles of Scilly



Source – (ONS, 2006b - *Reproduced under the terms of the Click-Use license*)

Figure 59 clearly shows the difference in contribution to GVA from the various industries. What is also clear is the difference in contribution at national, regional and county level from each industry. This is perhaps most obvious in the Real Estate, Renting and Business Activities industry which constitutes more than 25% of the national GVA yet in Cornwall and the Isles the contribution is 16%. The County's dependence on the tourist industry also shows in the contribution from Hotels and Restaurants, which is more than double the national and regional average. The same is true, albeit it to a lesser extent, of Agriculture, Hunting, Forestry and Fishing. These data are useful when identifying industries that could be developed in Cornwall and the Isles of Scilly to help the economy grow.

16.2. Economy – summary

- GVA in Cornwall and the Isles of Scilly is still one of the poorest in the Country. It is however increasing faster than the national average at present.
- The environmental impacts associated with economic growth must be considered. Cornwall has a heavy dependency on environmental quality for much of its revenue.
- There are many opportunities for growth and development in the emerging sectors such as renewable energy.

17. EVIDENCE BASE CONCLUSION

As stated previously many of the limitations to Cornwall and the Isles of Scilly's growth are not immediate and could in the short-term be overcome. However, the long term impacts and knock-on effects will ultimately affect environmental quality in Cornwall and the environment is the County's greatest asset. There are a number of limitations which require urgent action. Existing and forecast figures highlight resources which are at or very close to their service threshold. In some instances, there are no quick-fix options and careful, considered planning with a long-term attitude is required to avoid what will be serious consequences for the population and the economy. Table 36 below summarises the limitations with suggested timescale and actions.

Table 36 - Summary of limitations and proposed actions

Category	Limitation	Action	Government indicator
Section 3			
Emissions to air	Rising population numbers will increase carbon dioxide emissions from the domestic sector if per capita emissions are not reduced.	Encourage behavioural change in individuals to minimise per capita contribution of carbon dioxide.	NI 186 - (*Per capita CO_2 emissions in the LA area)* will encourage emissions reductions.
	Electricity accounts for 33% of domestic energy supply to Cornwall. Electricity has the greatest CO_2 emissions per kWh of most energy fuel types	Invest in low carbon renewable energy supplies to the County.	NI 186 - (*Per capita CO_2 emissions in the LA area)* will encourage emissions reductions.
	Increased emissions from the County may reduce the County's appeal for tourism and potential business investment.	Monitor carbon dioxide emissions using the SEI REAP model against other LAs and where applicable capitalise on green marketing.	NI 185 CO2 reduction from Local Authority operations PSA 27
	Finances may inhibit access to technology and lifestyle which enables reduced carbon dioxide emissions.	Provide financial support to those who want to be helped move to a low carbon lifestyle.	NI 186 - (*Per capita CO_2 emissions in the LA area)* will encourage emissions reductions.
	Increasing traffic may increase numbers of pollution hotspots increasing risk to human health.	Ensure plans within the LTP2 continue to contribute to lower congestion and lower pollution build-up.	NI 185 CO2 reduction from Local Authority operations PSA 27 NI 186 - (*Per capita CO_2 emissions in the LA area)* will encourage emissions reductions. SDI 61 – Air quality and health. SDI 65 – Local environmental quality
Section 4			
Water – domestic supply	Natural water storage capacity is finite, efficiency must be improved.	End users must reduce water consumption. Wider installation of water meters.	SDI 15 – Water resource use SDI 16 – Domestic water consumption
	Water leakage figures for Coliford SSA are 25..26 Ml/d.	SWW must continue to invest in supply efficiency i.e. reduce leakage from pipes.	SDI 15 – Water resource use
	SWW have no plans to create artificial reservoirs or desalination plants in the Colliford Strategic Supply Area before 2030.	N/A	SDI 15 – Water resource use
	Detailed data regarding tourist water consumption is not available therefore tourist impact cannot be accurately assessed.	Gather data regarding tourist water demand to improve strategic planning.	SDI 15 – Water resource use
Section 5			
Energy	Domestic renewable energy systems are often expensive and have long pay-back periods which are unattractive for potential investors.	Continue to develop domestic renewable energy technology to make it a more viable investment for domestic users.	SDI 4 – Renewable electricity
	Cornwall's energy consumption per capita is higher in part as a result of its aging demographic profile.	Actively target the worst demographic groups when seeking a reduction in emissions per capita.	SDI 6 – Household energy use
	Renewable energy is not being fully utilised in the County.	Continue to and increase investment in renewable technology in the County to help achieve the Government's renewable energy supply. Target and increase energy security in the County.	SDI 4 – Renewable electricity
	Limited fuel supply choice leaves many in the County without the option of choosing an energy source with fewer carbon emissions.	Provide consumers with energy supply choices. This will help the domestic and industrial sectors manage rising fuel prices and possibly avoid fuel poverty.	SDI 4 – Renewable electricity NI 187 Tackling fuel poverty – people receiving income based benefits living in homes with a low energy efficiency rating
	Rising fuel costs will increase the threat of fuel poverty for residents in Cornwall and Isles of Scilly. Particularly relevant for aging demographic.	Develop an affordable, secure supply of energy for the County.	NI 187 Tackling fuel poverty – people receiving income based benefits living in homes with a low energy efficiency rating
	A rising demand for renewable energy may be in direct competition with land for agriculture.	Long-term strategic planning to ensure land use for energy and agriculture is optimised.	
Section 6			
Food	A growing population will increase the demand for food leading to increased imports to the County therefore increasing the carbon footprint.	Localise food production and distribution thus reducing emissions (food miles).	
	Food consumption data specific to Cornwall for both	Collate specific food consumption data to	

	residents and tourists (per capita) are not available.	better inform strategic planning. This has particular significance given the rising domestic population.	
	Food production costs will continue to rise as fuel costs rise.	Localise food production and distribution thus reducing energy costs and final high street costs (see the Cornwall food programme).	
	Changes in climate and extreme weather events may reduce crop yield.	Thought must be given to agricultural practices and where appropriate new crop opportunities.	NI 188 Adapting to climate change PSA 27
Section 7			
Waste	Two major landfill sites in Cornwall will close in 2010 and 2014.	Install the required infrastructure to meet waste disposal demands by 2014.	
	The growing population will increase municipal waste produced in the County.	Encourage recycling and composting to reduce per capita waste.	NI 191 Residual household waste per head Defra DSO NI 192 Household waste recycled and composted Defra DSO
	Accurate tourist generated waste per capita data are not available.	Investigate Cornwall specific tourist generated waste. Data will be used to inform sustainable tourism plans as well as the tourist contribution to the County's total municipal waste.	NI 193 Municipal waste land filled Defra DSO
	Rising fuel costs will increase the cost of waste transportation.	Investigate waste transportation fleet fuel efficiency and emissions and where possible improve the fleet.	NI 185 CO2 reduction from Local Authority operations PSA 27
Section 8			
Transport and Traffic	Increasing population and vehicle registration will increase subsequent traffic on what are in some cases already congested roads.	Encourage increased use of public transport. Provide safe, affordable and reliable public transport.	NI 175 Access to services and facilities by public transport, walking and cycling DfT DSO NI 177 Local bus passenger journeys originating in the authority area DfT DSO NI 178 Bus services running on time DfT DSO NI 167 Congestion – average journey time per mile during the morning peak PSA 5
	The dominant mode of transport to work in Cornwall is private car.	Encourage car sharing and alternative modes of transport to work to reduce the load on roads during rush hours.	NI 176 Working age people with access to employment by public transport (and other specified modes) DfT DSO
	The majority (74%) of tourists visiting Cornwall arrive by car increasing congestion around tourist hotspots.	Provide and promote safe, reliable, practical, low impact alternative access to the County.	
	Increasing traffic may increase numbers of pollution hotspots increasing risk to human health.	Ensure plans within the LTP2 continue to contribute to lower congestion and lower pollution build-up.	NI 185 CO2 reduction from Local Authority operations PSA 27 NI 186 - (*Per capita CO_2 emissions in the LA area)* will encourage emissions reductions. SDI 61 - Air quality and health. SDI 65 – Local environmental quality.
	Increasing traffic and subsequent congestion/queuing may result in economic losses as well as reduced quality of life.	Ensure plans within the LTP2 continue to address and where possible alleviate congestion in the County.	
	The proposed Newquay airport expansion may increase carbon emissions in Cornwall. This may make achieving new National Performance Indicators difficult to achieve.	Further investigation of the long-term environmental impacts of the airport expansion is required before committing to significant investment.	NI 185 CO reduction from Local Authority operations, NI 186 Per capita CO2 emissions in the LA area, NI 194 Level of air quality – reduction in NOx and primary PM_{10} emissions through local authority's estate and operations and,

Section 9			
Land use and conservation	There is at present no accurate and regular data collection for land use in Cornwall.	Support the Land Mapping Project proposal and increase the project frequency. Data generated can assist land use monitoring and impacts of growth.	SDI 24 – Land use
	Demand for food and energy is increasing whilst demand also exists to maintain habitat.	Land use prioritisation will require thoughtful planning so as not to inhibit resource supply but also to ensure the future of vulnerable habitats.	SDI 24 – Land use
	Plans for 40,000 new homes between 1996 and 2016 in Cornwall to meet the demand of the population will require large areas of land thus losing the environmental services of the land.	Long-term, holistic planning must be employed now to ensure new housing has minimal environmental impact.	SDI 24 – Land use SDI 25 – Land recycling
Section 10			
Biodiversity	The resources needed to make full use of the extensive biodiversity data collected in the County are not available.	Provide the investment needed to interpret and utilise the biodiversity to help monitor change as a result of growth.	SDI 20 – Bird populations SDI 21 – biodiversity conservation NI 197 Improved local biodiversity – active management of local sites PSA 28
Section 11			
Fresh water environment	Cases of eutrophication in fresh water systems have been identified in Cornwall, the result of high inputs of nitrates and phosphates.	Identify sources of nitrates and phosphates and reduce to levels which allow water systems to return to their former quality.	SDI 21 – biodiversity conservation NI 197 Improved local biodiversity – active management of local sites PSA 28
Section 12			
Marine water environment	Rising fuel costs will increase the cost of landing fish and shellfish forcing high street prices up.	Investigate costs of supplying cheaper fuel (possibly bio fuel) to major ports in the County.	
	Inshore shellfish fishery water quality in the County means shellfish have to be treated before they are fit for consumption.	Improve water quality by improving sewage treatment to create a Class-A fishery.	
	The growing population will increase demand on water sewerage systems. This coupled with a forecast for increased heavy precipitation events could overload treatment plants resulting in sewage spills in coastal waters.	Identify the capacity of sewage treatment systems in Cornwall and ensure (with investment if necessary) treatment plants can cope with increased forecast demand.	NI 188 Adapting to climate change PSA 27
Section 13			
Demographics	The growing population of Cornwall is increasing demand on resources throughout the County.	Steps outlined in this table must be taken to decouple population growth from resource demand.	
Section 15			
Quality of life	The Quality of life survey identified 38% of the County's population thought the Cornish environment was getting worse.	Raise the profile of positive environmental impacts in the County.	SDI 60 – Environmental quality
Section 16			
Housing	Lack of affordable housing will make property purchase for low-income first time buyers difficult.	Provide affordable housing with suitable legislation to support first time buyers.	NI 155 Number of affordable homes delivered (gross) PSA 20
	Plans for 40,000 new homes between 1996 and 2016 in Cornwall to meet the demand of the population will require large areas of land thus losing the environmental services of the land.	Long-term, holistic planning must be employed now to ensure new housing has minimal environmental impact.	NI 154 Net additional homes provided PSA 20
Section 17			
Economy	Poor (but improving) GVA of the County may deter investment in the County.	Capitalise on opportunities to develop emerging sectors such as renewable energy. Utilise the increasing provisions for higher education in the County for the required workforce.	NI 172 VAT registered businesses in the area showing growth BERR DSO

18. DETERMINE THE POSITION AND LINKAGE OF CORNWALL IN TERMS OF ENVIRONMENTAL SUSTAINABILITY AGAINST GLOBAL IMPACTS (INCLUDING NATIONAL AND INTERNATIONAL RELATIONSHIPS)

Every individual has a responsibility to minimise their impact on the environment in which they work, live and play. Impact minimisation is a more cost effective method than creating secondary, mitigating actions that attempt to undo the damage caused. The level to which people are willing to minimise their impacts is heavily influenced by the society they live in. In broad terms societies in the Western world are energy inefficient, resource intensive, and have a greater impact on the environment than societies in less wealthy/developed regions of the world. This is of course not entirely accurate as there are exceptions to the statement at various levels, from individual to country performance. There is a need for bold decisions to be made if those countries that have settled into unsustainable lifestyles are to change their attitude and reduce what is in some cases a huge and disproportionate demand on global resources. In much the same way an evidence base is needed to identify change in Cornwall and the Isles of Scilly, wide-scale and even global bench-marking is needed to identify global change. By monitoring and comparing performance in terms of environmental impact, lessons can be learned and ways of reducing detrimental impacts employed to ensure the resources on Earth can be sustained for the future as they have been in the past.

The following sections will look at the performance of Cornwall and the Isles of Scilly using carbon and ecological footprints as an indicator and method of comparison with other counties and similar areas. It will also look at the measures in place to deal with changes associated with climate change and will look to other areas for examples of best practice.

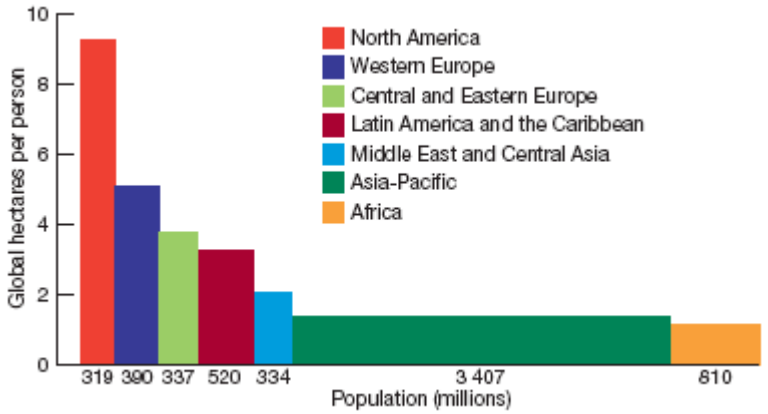
19. ECOLOGICAL FOOTPRINT

The previous sections have looked at the baseline conditions of much of the Cornish environment and where possible identified trends using historical data to determine whether situations were stable, declining, or improving. In some cases, crude forecasts were made where activity could be linked to population size and therefore increased activity impacting on the environment could be linked to population size increase. The details of the earlier sections i.e. the environmental conditions such as water demand and air quality were treated as separate entities and not linked holistically to the actions of an individual. In recent years the concept of carbon footprints has been developed where total carbon emissions resulting from the actions of an individual, a community or even a country are calculated to estimate the environmental impact. The idea has rapidly grown to the point at which carbon is almost an environmental currency. Businesses and Local Authorities are ranked according to their carbon emissions, cars are sold by their emissions profile and even socially, some individuals strive to have a smaller carbon footprint than their colleagues.

It is easy to compare the numbers generated by carbon calculators but the reality of carbon footprints for the average lay person unclear. It is difficult to translate the footprint size i.e. amount of carbon emitted with actual environmental impact. Having a smaller carbon footprint than the next person doesn't mean the environmental impact is acceptable. Ecological footprints (discussed in more detail below) do have a target figure which helps users put their footprint into context. The more recent "footprint" concept is one which measures ecological impact and the demand placed on land and sea to meet the lifestyle impacts of an individual. It also includes the land required to deal with waste generated and the emissions associated with processes involved in supplying the demand. This generates a figure for the area of land required to support the lifestyle. The area of land is considered in a global context which allows comparison around the world. For example, if we equally shared the productive land on Earth across the global population, each individual would be left with 1.8 global hectares (gha) to support their lifestyle (South West Observatory, 2007c). In reality however, land is not shared equally and as a global population we are using land at a rate which is not sustainable. We are in "ecological overshoot" (WWF, 2007).

Figure 60 below shows the average ecological footprint per person in seven regions of the world. This clearly shows the significantly higher impact of the western world in terms of global hectares (gha) required to support the lifestyle.

Figure 60 - Ecological footprint measured in global hectares for seven regions of the world

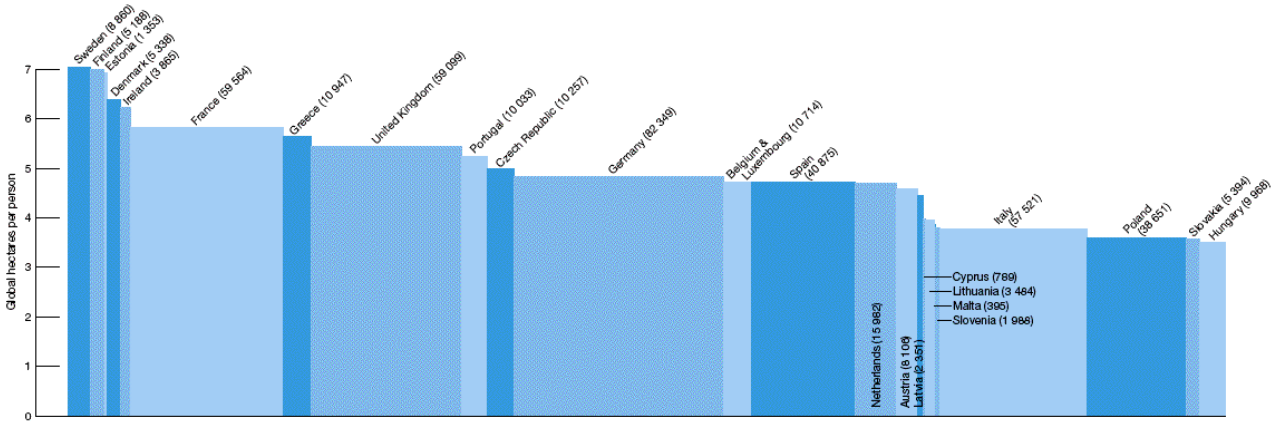


Source – (WWF, 2004).

If the demands outlined in Figure 60 are treated holistically, the population on Earth at present would need three planet Earths to survive (WWF, 2004). This figure is likely to increase unless attitude and behaviour change or until the lack of resources simple dictate that life can no longer be lived in the same way. The World Wildlife Foundation is leading a "One Planet living" campaign whereby humanity only uses the resources on Earth at a rate and capacity it can supply.

Figure 61 below details the ecological footprint of the EU-25 nations. This again shows how all countries are above the 1.8 gha share per person.

Figure 61 - Ecological footprint measured in global hectares for the EU-25 nations



Source – (WWF, 2004)

Despite the general rise in ecological footprint size (gha) per person, Poland has succeeded in reducing its footprint per person whilst the economy has continued to grow (WWF, 2004). The country still uses more than 3 gha per person but, examples like this must be followed by other developed and developing countries if a sustainable society is to be achieved. Unlike Poland, the UK has seen growth in its economy and its ecological footprint, the average footprint per person being 5.4 gha, three times the 1.8 gha value which is considered sustainable. The following Section will look at the contribution from Cornwall and other areas of the UK that contribute to the UK's 5.36 gha average per capita.

19.1. Ecological footprint of Cornwall and the Isles of Scilly

The Stockholm Environmental Institute and Centre for Urban and Regional Ecology have designed a tool for calculating the ecological footprint of Local Authorities, regions and the UK as a whole. The modelling tool called

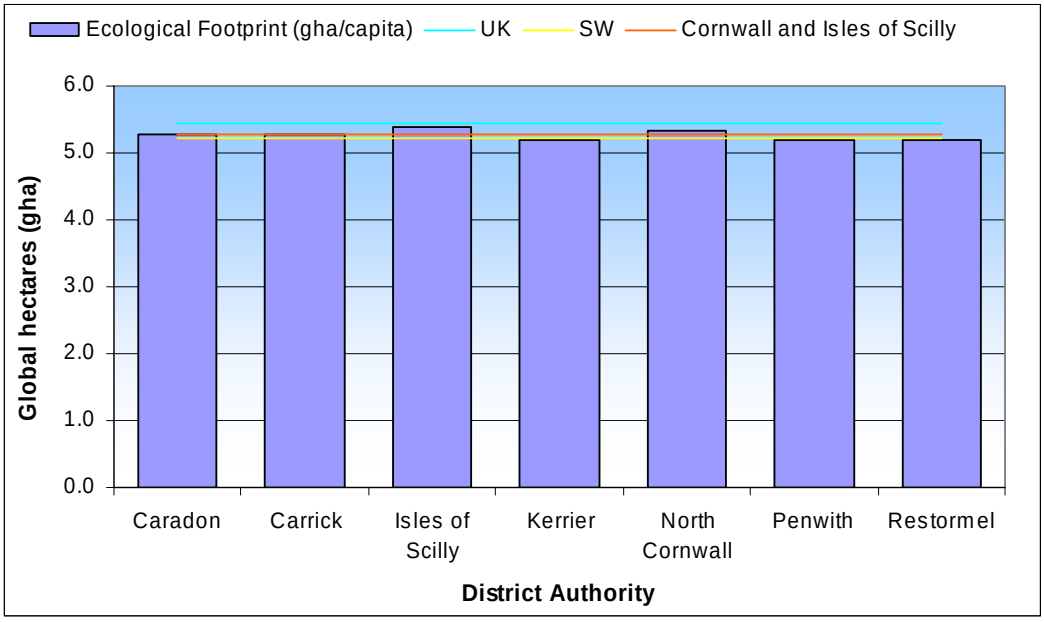
Resources and Energy Analysis Program (REAP) was launched in 2006 and has since been used by Local Authorities to assess their current performance and consider strategies to reduce their impact in the future (DEFRA, 2007n). As with all models, the accuracy of the output is dependent on the accuracy of the input. There should also be additional data specific to the Local Authority provided by the Local Authority to ensure the output (footprint) is a fair reflection of the area. The ecological footprints for Cornwall referred to in this report have been compiled using the national data sets. There is therefore an element of error in each although SEI do not specify what level of error that is likely to be.

The total ecological footprint is broken down into eight categories;

- Housing
- Transport
- Food
- Consumer items
- Private services
- Public services
- Capital investment
- Other

The detail of the eight categories for Local Authorities in Cornwall and elsewhere in England can be accessed online at the following address www.sei.se/reap/download_login.php?region=l.
Local Authority rankings are based on the ecological footprint per capita rather than the total figure to allow comparisons between LAs with different population densities. Figure 62 below shows the ecological footprint per capita in the Districts in Cornwall.

Figure 62 - Ecological footprint per capita for District Authorities in Cornwall.



Source – (SEI, 2007a)

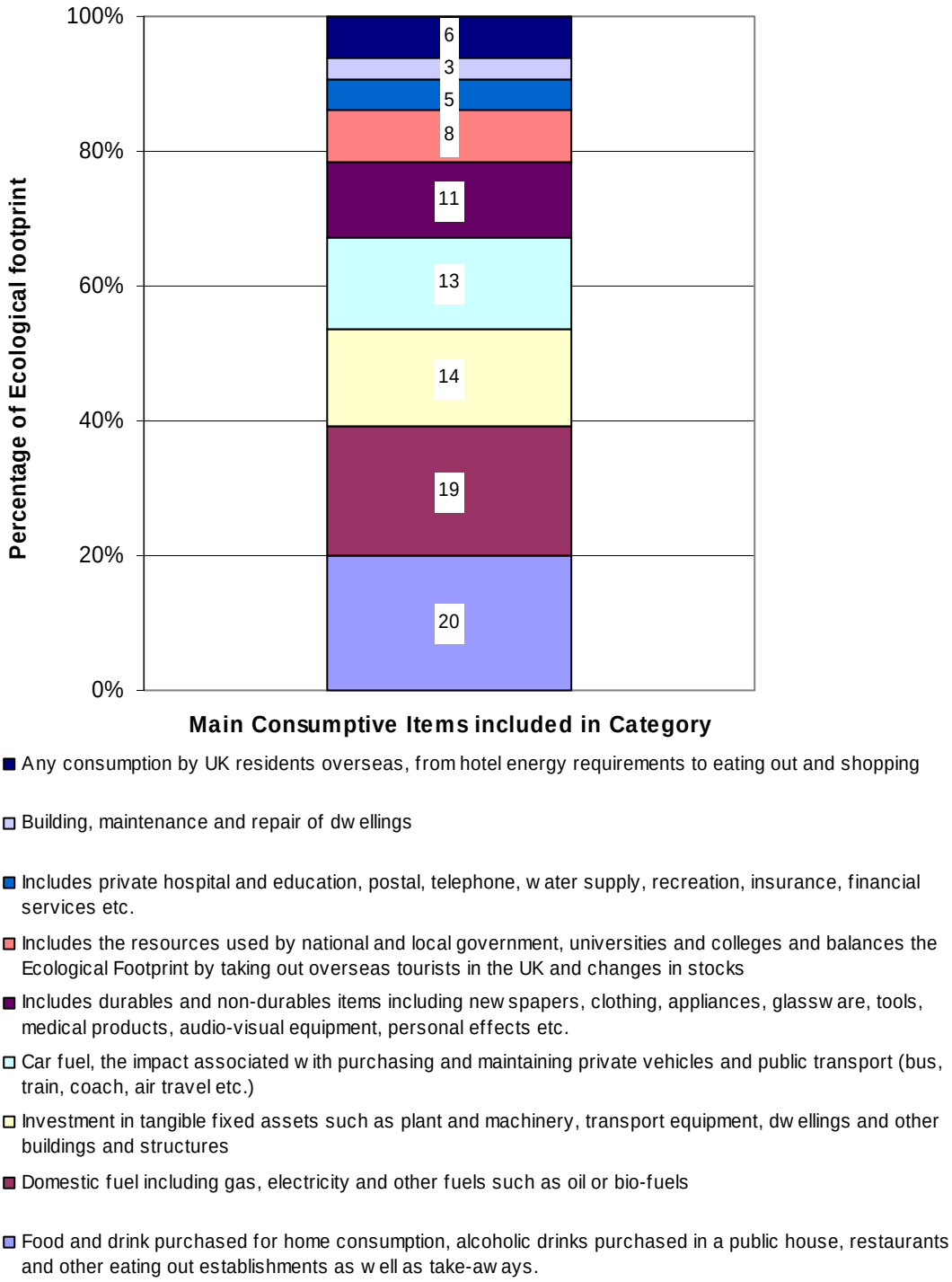
These small differences between ecological footprint size are in reality negligible considering the average amount of land required to support the population in Cornwall and the Isles of Scilly is 3 times greater than the 1.8 gha "fair share". The differences (which amount to fractions of a hectare) could be attributed to the quality and accuracy of data used to calculate the footprint.

Using the data generated by SEI, total ecological footprint of the County is 2.6 million gha, an area seven times greater than Cornwall and the Isles of Scilly combined. This figure demonstrates the impacts of the population in Cornwall go way beyond the political boundaries of the land.
The total ecological footprint is broken down into eight categories;

- Housing
- Transport
- Food
- Consumer items
- Private services
- Public services
- Capital investment
- Other

The impact of each category is understandably different. Figure 63 below shows the contribution from each category to Cornwall and the Isles of Scilly's average ecological footprint (5.27 gha).

Figure 63 - Breakdown of Cornwall and the Isles of Scilly's ecological impact.



A European research project to identify the environmental impact of products (EIPRO) identified similar results to those yielded by the REAP generated ecological footprint. Although the categories are not directly comparable and the research was across Europe, both projects identified four activities were responsible for around 60% of the total impact. Table 37 below shows the four categories with the greatest impact identified by EIPRO.

Table 37 - Environmental Impact of Products (EIPRO) - largest impacts

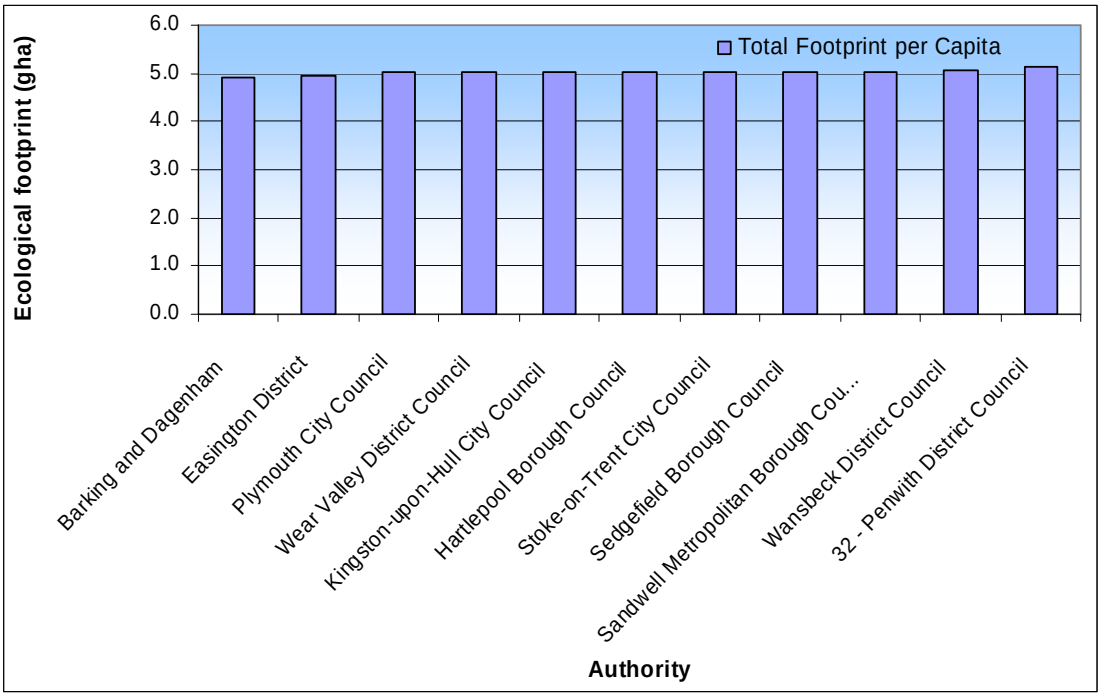
Category	Impact (%)
Food and drink	20-30
Passenger transport	15-35
Housing, including buildings, construction and appliances	20-35
Clothing	5-10

Source – (Tukker *et. al*, 2006)

19.2. Authority comparison – ecological footprint per capita

As mentioned previously, the ecological footprint per capita can be used to compare the performance of Local Authorities in England, Wales and Scotland. Below in Figure 64 is a comparison of the 10 Authorities with the lowest ecological footprint as well as the average footprint of Cornwall and the Isles of Scilly. The top performing Local Authorities have an average ecological footprint of just under 5 gha per capita with the best being Barking and Dagenham London Borough Council.

Figure 64 - Authorities with the smallest ecological footprint per capita in England. Scotland and Wales



Source – (SEI, 2007a)

None of Cornwall's District Authorities appear in the top 10 performing authorities in terms of average ecological footprint per capita. The best in Cornwall is Penwith District Council in 32nd position. The positions of the remaining Cornish authorities are listed below in Table 38. The Isles of Scilly come out as the worst performer although when put in context, the island authority has an average ecological footprint 0.47 gha larger than best performing authority.

Table 38 – Ecological footprint performance – the position of Cornish authorities in a national context

Authority	Rank	Ecological footprint gha per capita
Penwith District Council	32	5.13
Restormel Borough Council	34	5.14
Kerrier District Council	41	5.15
Carrick District Council	76	5.23
Caradon District Council	83	5.23
North Cornwall District Council	95	5.25
Isles of Scilly	170	5.37

Source – (SEI, 2007a)

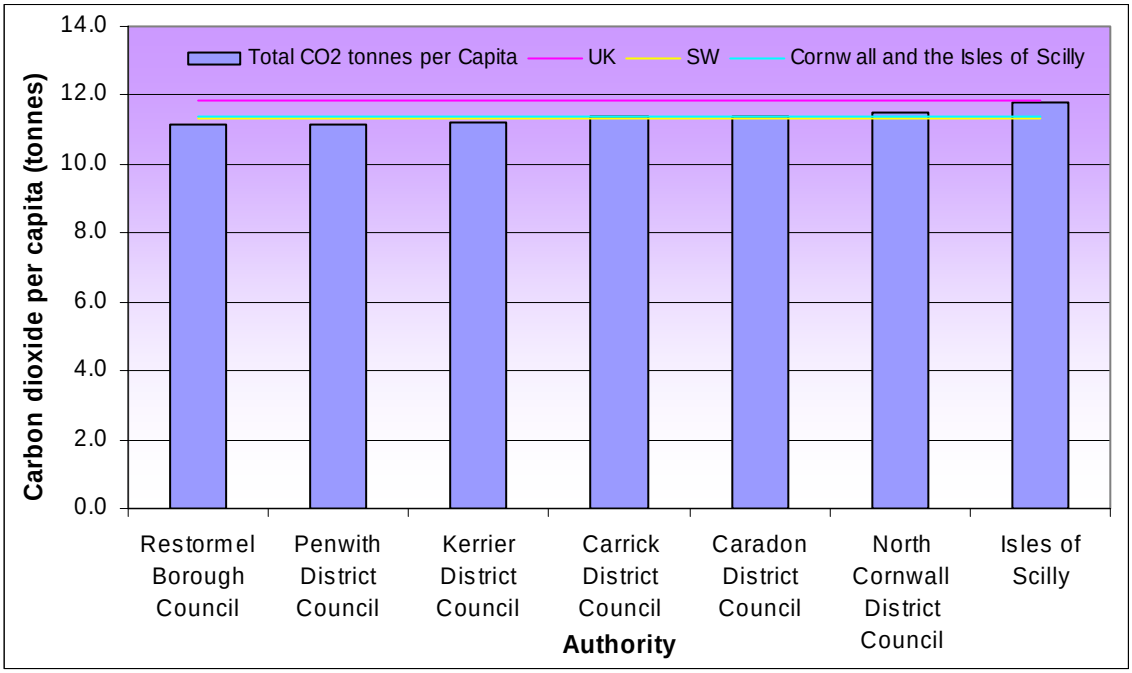
The position of the authorities in a national comparison is perhaps irrelevant given that all are well over the "fair share" value of 1.8 gha. The importance of the figures generated in Table 37 is how they can be used to reduce ecological impact. Economic growth must be decoupled from environmental impact if the forecast growth of the county is to be mitigated.

In summary, all of the Local Authorities in Cornwall and the UK are currently using an area of land to supply their demands way in excess of what is deemed a global fair share. Although the ecological footprints may not be a perfect reflection of the ecological footprint per capita in every Local Authority due to the gross approximations implicit in the data used to calculate the footprint, it is clear the necessary change and challenge to achieve that change is huge.

19.3. Carbon footprint of Cornwall and the Isles of Scilly

As stated in earlier sections, the concept of carbon footprints has now been in use for several years, yet few have a true understanding of the environmental consequence of their carbon footprint. That is simply a reflection of the complexity of the issue rather than a suggestion that few have the knowledge to understand the true impact. However, despite their complex nature carbon footprints are still a useful proxy for identifying efficiency in terms of resource and energy use. As with the ecological footprints in the previous sections, this Section will look at the carbon footprints of the Districts in Cornwall (Figure 65), look at the authorities with the lowest smallest carbon footprint per capita in England, Scotland and Wales as well as the performance of the authorities in Cornwall in a national context.

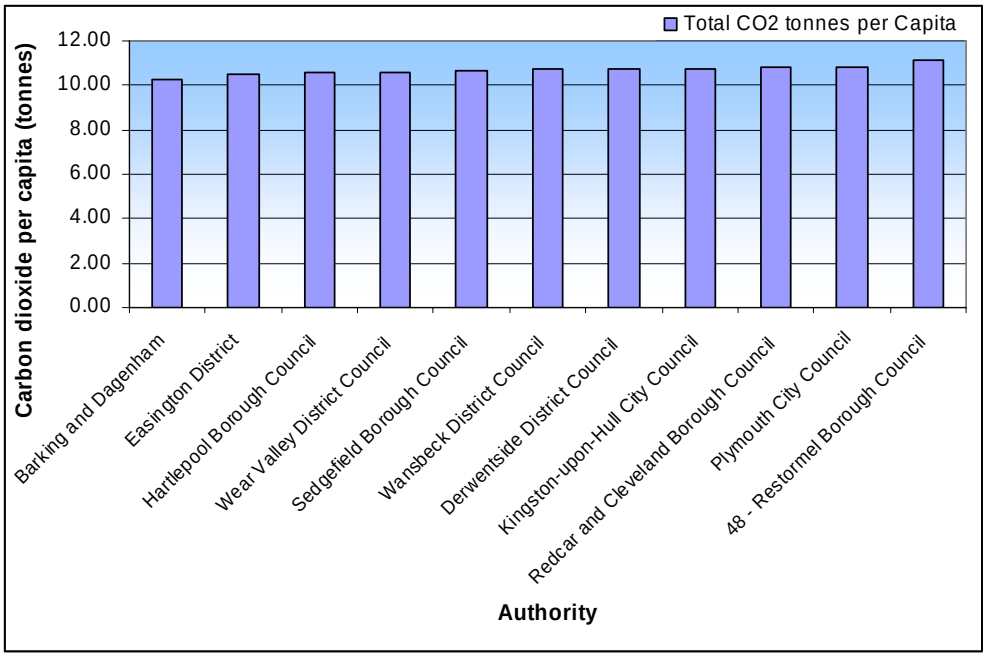
Figure 65 - Carbon footprint per capita for District Authorities in Cornwall



Source – (SEI, 2007a)

As with the ecological footprints, there is very little difference between the size of the average carbon footprint per capita in the seven districts in Cornwall (11.37 tonnes). The average for England is 11.87 tonnes and, as with the ecological footprints, the average carbon footprint in the South West is slightly smaller than the national average at 11.35 tonnes.

Figure 66 – Authorities with smallest carbon footprint per capita in England, Scotland and Wales



Source – (SEI, 2007a)

Once again, none of the Cornish authorities appear in the top 10 performers in England, Scotland and Wales in terms of carbon dioxide emissions per capita the best being Restormel Borough Council. The Cornish authorities

that do not appear in Figure 66 above are listed in Table 38 below which includes the position of the authorities in a national context. Interestingly some authorities feature in both Figure 64 (Authorities with the smallest ecological footprint per capita in England. Scotland and Wales) and Figure 66 (Authorities with smallest carbon footprint per capita in England, Scotland and Wales) suggesting the two are linked. This ought to be an attractive outcome for Authorities seeking to reduce their environmental impact as well as meet the performance indicators set out in the new performance framework (DCLG, 2007).

Table 39 - Carbon footprint performance – the position of Cornish Authorities in a national context

Authority	Rank	Total CO_2 tonnes per capita
Restormel Borough Council	48	11.16
Penwith District Council	49	11.17
Kerrier District Council	56	11.21
Carrick District Council	88	11.36
Caradon District Council	99	11.40
North Cornwall District Council	123	11.50
Isles of Scilly	199	11.81

Source – (SEI, 2007a)

Other than the order of Restormel and Penwith, the performance of the districts in Cornwall is exactly the same when comparing carbon emissions per capita and ecological footprint per capita. The performance in a national context is slightly worse from a carbon footprint point of view.

Unlike the ecological footprints, no "optimum" carbon footprint has been calculated. The target Authorities will have to work towards is a reduced carbon footprint per capita. This will be measured specifically as part of the new Local Authority performance indicators (National Indicator 186, Per capita CO_2 emissions in the LA area (DCLG, 2007)).

The importance of reducing the demand on resources cannot be emphasised enough. The previous sections have highlighted the baseline conditions of many resources and the limitations to growth these pose if society continues "business as usual". It is therefore paramount that influential bodies and authorities first recognise the situation and second act by providing support to the intervention actions required.

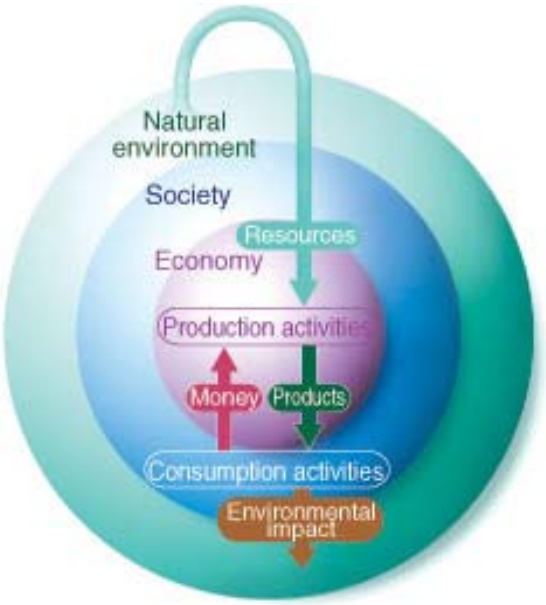
19.4. The impact of Cornwall and the Isles of Scilly on the global ecosystem

Earlier sections of the report detailing carbon emissions from Cornwall and the Isles of Scilly have shown the relatively tiny contribution to global emissions. The contribution per capita in Cornwall is around average for the UK. There needs to be a dramatic reduction of per capita emissions (NI 186, Per capita CO2 emissions in the LA area) which must come from a reduction in demand *and* improvement of efficiency. Steps to help achieve this are included in Table 36.

Residents in Cornwall use an area of land approximately 3 times greater than the size of Cornwall to sustain the lifestyle they lead. This is the result of growth and economic prosperity which has afforded luxuries sourced from beyond the political boundaries of the County. This has left us with very high expectancies in life, an attitude which is difficult to change. Regrettably during the same period there has been a failure to recognise the widening detrimental environmental, social and economical impact on areas outside Cornwall, a consequence of the ever growing demand. In the complex, global market which has evolved it is almost impossible to detail each and every action in Cornwall which has an impact beyond its boundaries.

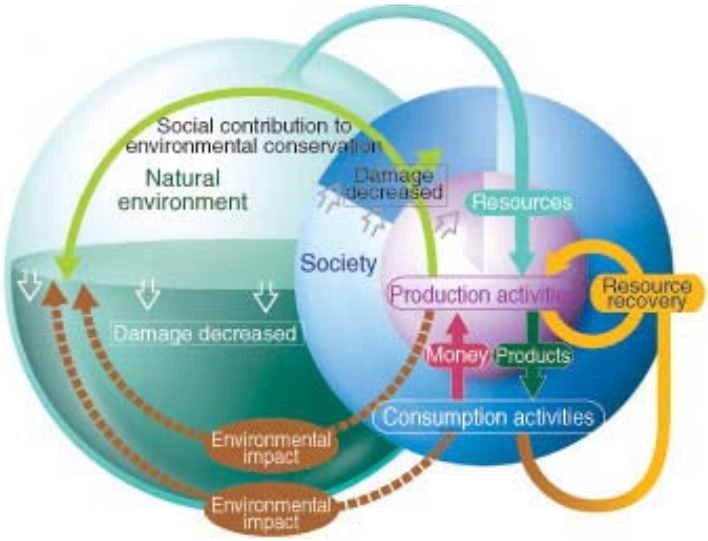
The figures below (67, 68 and 69) illustrate the relationship between the environment, society and the economy from pre-industrialised times to the situation required to achieve the ideal triple bottom line.

Figure 67 - The relationship between the environment, society and economics - pre-industrial



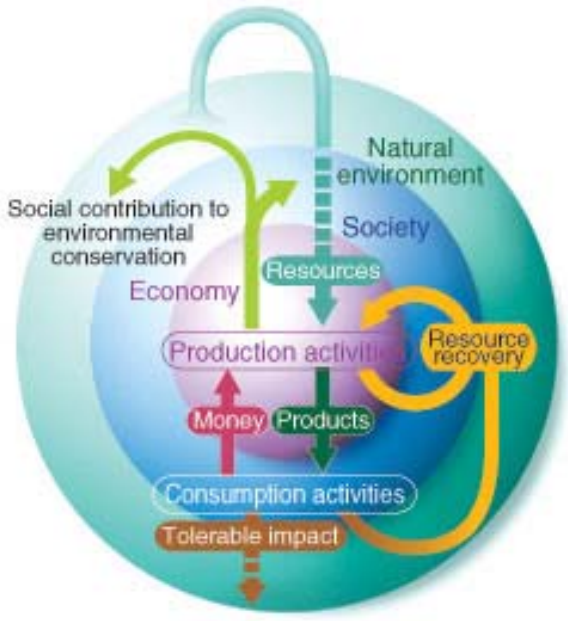
Source – (RICOH, 2008)

Figure 68 - The relationship between the environment, society and economics - present day



Source – (RICHO, 2008)

Figure 69 - The relationship between the environment, society and economics - Future ideal



Source – (RICHO, 2008)

Understanding this concept may be instrumental to encouraging behaviour change that results in a shift towards living on a fair share of land.

20. THE RESPONSIBILITY OF LOCAL/UNITARY AUTHORITY

Influence can come from a variety of sources but the most likely in any area will be the Local Authority. As the recent report, "*A climate of change*" produced for the Government on historic Local Authority performance with regard to climate change states,

> *"Local government is uniquely placed to tackle climate change with a democratic mandate for action, close proximity to citizens, and a strategic role leading other public, private and voluntary sector partners"* (LGA, 2007).

Local Authorities themselves have a duty to deliver what national Government dictates but the way in which they go about this can vary. Local Government in Cornwall is about to undergo two significant changes to the way it is run and measured; one is the move to a Unitary Authority and the other is the change in performance indicators. The move to Unitary Authority will see Cornwall run by one council rather than the existing District and Borough Councils and the County Council.

> *"This will save more than £17 million of Cornish tax payers' money a year, deliver improved, more efficient and community focused services, give local communities more say in decision making and provide Cornwall with a stronger voice with which to lobby the Government".* (CCC, 2007c).

The forecast improvements should stem largely from the community networks which will be spread across the County and this is where there will be opportunity to influence changes that will reduce environmental impact. The incentive to encourage change from the new Unitary Authority point of view will come from the new performance indicators. If the 14 "Outcomes" (see Table 40 below) which fall under Environmental Sustainability category are to be achieved, it is in the Authority's best interest to encourage and support the measures and actions needed. There is also an opportunity for the Unitary Authority to lead by example as the carbon dioxide emissions of the Authority operations will be estimated. Failure to demonstrate improvements is unlikely to encourage the residents of Cornwall to reduce their own environmental impact which will make achieving

performance indicators such as reducing CO_2 per capita and increasing the amount of waste recycled and composted difficult for the Authority to accomplish.

Table 40 - National indicators for local Government - Environmental Sustainability category

Environmental sustainability	NI 185 CO_2 reduction from Local Authority operations PSA 27
	NI 186 Per capita CO_2 emissions in the LA area PSA 27
	NI 187 Tackling fuel poverty – people receiving income based benefits living in homes with a low energy efficiency rating Defra DSO
	NI 188 Adapting to climate change PSA 27
	NI 189 Flood and coastal erosion risk management Defra DSO
	NI 190 Achievement in meeting standards for the control system for animal health Defra DSO
	NI 191 Residual household waste per head Defra DSO
	NI 192 Household waste recycled and composted Defra DSO
	NI 193 Municipal waste land filled Defra DSO
	NI 194 Level of air quality – reduction in NO_x and primary PM_{10} emissions through local authority's estate and operations. PSA 28
	NI 195 Improved street and environmental cleanliness (levels of graffiti, litter, detritus and fly posting) Defra DSO
	NI 196 Improved street and environmental cleanliness – fly tipping Defra DSO
	NI 197 Improved local biodiversity – active management of local sites PSA 28
	NI 198 Children travelling to school – mode of travel usually used DfT DSO

Source – (DCLG, 2007)

There has been some criticism of the new indicators and particularly their value to areas such as Cornwall where indicators specific to the landscape, geography and habitat would be of more value than the generic choices included here. Also, given that these indicators are the *only* indicators by which the Unitary Authority will be assessed by central Government, budget is likely to be focused on what is measured, potentially limiting opportunities to improve performance elsewhere.

20.1.1. The Nottingham Declaration

One way for Local Authorities to prepare themselves for the anticipated impacts of climate change, improve performance with regard to environmental sustainability, and "lead by example", is to sign the Nottingham Declaration. The Nottingham Declaration is essentially a list of actions which Authorities agree to acknowledge and implement to reduce its impact on the environment in the 21st century (Energy Saving Trust, 2007). Signing up to the declaration includes acknowledgment that the Authority will work at various levels from national Government to local communities and that the work and actions will result in social, economic and environmental benefits.

Cornwall County Council signed the Nottingham Declaration in March 2007 and this will result in support of schemes which reduce the impact of the County on the environment and climate change.

20.1.2. Beacon Status – sustainable energy

In 2005 Cornwall County Council was awarded Beacon status under the Sustainable Energy theme. The award was for a variety of work which included tackling fuel poverty, including sustainable energy, in the Local Strategic Partnership with the support of the Cornwall Sustainable Energy Partnership and integrating renewable energy into the regeneration schemes within the County. Many of the actions associated with the Sustainable Energy theme result in lower carbon emissions and reduced energy demand as a result of more efficient energy use.

20.1.3. Sustainable Communities Strategy

Cornwall County Council and every other Local Authority in the country have a community strategy. A community strategy is essentially a plan to develop a community that is safe, prosperous and fair. They are written in conjunction with representatives from private and public sectors, organisations and community individuals. Local Authorities are being asked to embed sustainability into these strategies by,

"Developing a stronger focus on integrating social, economic and environmental issues and by tackling the longer-term and global impacts of communities" (http://www.sustainable-development.gov.uk/advice/local/localleadership.htm#creating).

The intended outcome is a community that is developed to meet its aspirations and when this is achieved, it can also be sustained and so too can its wider and long-term impacts.

Although not yet complete, the aims of the strategy will include a wide range of environmental issues. This is necessary to achieve the balanced triple-bottom line which Cornwall County Council has set itself. The areas to be included in the strategy are;

- Waste
- Energy
- Biodiversity
- Rural areas & agriculture
- Public open space
- Community engagement
- Clean, healthy, productive and biologically diverse inshore waters
- Access to goods and services
- Awareness, education, skills and training
- Research and intelligence

The success of the strategy can be assessed in two ways. First, does it meet the requirements of the community? This can be measured including the use of quality of life surveys. Second, is it sustainable? This can be measured against an evidence base of environmental data. Previous sections in the report include much of the data needed but it must be kept up to date if it is to be used with any confidence and accuracy. The gaps in the data identified in this report are included in the conclusion.

20.2. Acting on the evidence

Some Authorities have seized the opportunity to use the freely available footprint data produced by SEI and are now implementing strategies and actions as a result. These forward thinking authorities are creating a culture of resource use efficiency and reduced environmental impact whilst at the same time making financial savings and improving social well-being. These authorities will be included in the following section and lessons which could be adopted in Cornwall and the Isles of Scilly will be highlighted.

20.2.1. Sustainable Scotland

All 32 Local Authorities in Scotland have signed the Climate Change Declaration. The Declaration not only acknowledges that Local Authority operations and estates must reduce emissions (on average 30,000 tonnes per annum) but more importantly the communities in each Local Authority (which on average generate 1.8 million tonnes) must be engaged to also reduce emissions of carbon dioxide resulting in a much larger and more significant impact (SEI, 2007b). The Declaration will be a vital vehicle for achieving the Government's ambitious target of reducing carbon emissions by 80% by 2050 (SSN, 2007). Critically, the Local Footprints report produced by the SEI for the Scottish Local Authorities recognises that,

> "*…steps should be taken based on evidence rather than a faith that local initiatives and policy interventions will make a difference*".

This may seem like an obvious statement but until very recently, freely accessible footprint data was not available and pledges by local government to reduce environmental impact could not be easily monitored and measured and, as a result, minimising environmental impact was not top of the agenda nor did it receive significant funding. Now information is accessible and, performance indicators have been introduced to monitor Local Authority efforts, action will have to be more forthcoming.

21. PHYSICAL IMPACTS OF CLIMATE CHANGE IN CORNWALL AND THE ISLES OF SCILLY

Many of the businesses and industries in Cornwall and the Isles of Scilly are directly dependent on or indirectly linked to climatic conditions. For example, temperature and rainfall are crucial for farming practices and changing weather patterns may require adaptation of crops and learning new skills to fully utilise new crops as well as contingency plans for extreme weather events such as heatwaves or floods. The tourism industry and the many businesses it includes have a complex relationship with the climate. The environmental quality of Cornwall and the Isles of Scilly is the industry's greatest asset. Many may see hot dry summers as the perfect climate change forecast but this may change the very environment people come to enjoy.

The threat of increased stress on land as a result of climate change is very real. As with all modelled forecasts, the exact detail isn't known but trends of growing significance are being forecast with increasing certainty and worryingly the changes are happening faster than the early forecasts had predicted. The following Sections include forecasts and discussions the possible repercussions of climate change in Cornwall.

21.1. Forecast climate change for the South West region

In 2003 the South West Climate Change Impacts Partnership (SWCCIP) published a report which included changes in climatic conditions for the South West seasons. The forecasts which were made by the UK Climate Impacts Programme models show the expected changes for 2050 and 2080 (Table 41 below).

Table 41 - Forecast seasonal climatic changes in the South West in 2050 and 2080

Season	*Anticipated Climate around 2050s*	*Anticipated Climate around 2080s*
Spring	Warmer by 1.0 to 2.0°C	Warmer by 1.5 to 3.5°C
	precipitation totals similar to present	precipitation totals similar to present
Summer	Warmer by 1.5 to 3.5°C	Warmer by 2.0 to 5.5°C
	Drier by 15 to 30%	Drier by 25 to 55%
Autumn	Warmer by 1.5 to 3.0°C	Warmer by 2.0 to 5.0°C
	Drier by 0 to 10%	Drier by 5 to 15%
Winter	Milder by 1.0 to 2.0°C	Milder by 1.5 to 3.5°C
	Wetter by 5 to 15%	Wetter by 10 to 30%
		Snowfall less by 70 to 90%

(SWCCIP, 2003)

Every season has forecast increased temperature and every season except winter is forecast to be drier. The reality of the forecast is that it may already be out of date as the IPPC have already identified that changes are

occurring faster than expected and therefore even the biggest temperature changes in Table 41 are likely to be conservative. Some of the possible environmental impacts are discussed below.

21.1.1. Changes to the land

Warmer and drier conditions through spring to autumn will put significant stress on the vegetation that has grown in the region due to its mild and (importantly) moist, climatic conditions. Less rainfall could be a disaster for natural vegetation whilst agriculture will have to adapt and either supply water to maintain the existing crops (a very expensive exercise given the fact water will be an increasingly precious resource) or the crop will have to change. The drier conditions may lead to more exposed land (a result of vegetation loss) which will be more vulnerable to erosion in the following winter where rainfall is actually forecasts to increase. This would lead to a loss of nutrients and therefore land quality potentially reducing the following year's crop yield.

21.1.2. Changes to the biodiversity

Animals react to seasons and will either migrate to a climate suitable for their requirements of they will hibernate. If year-round conditions change, migration patterns would alter to the point where some species disappear whilst others "move in". This brings the threat of invasive species. To a large degree, Cornwall and the Isles of Scilly (as well as the rest of the UK) are protected from invasive species due to the fact of being on an island (making natural migration by flight-less mammals, difficult). What could happen (and evidence suggests is already happening) is the migration of insects. This could put indigenous species (and both biodiversity and vegetation) under threat through competition.

21.1.3. Changes in the marine environment

Lacking physical barriers other than their surrounding environment marine species can easily migrate to and away from the UK coastline. As the agricultural industry must consider its produce, so too must the fishing industry. Traditional species may no longer be a feature of the Cornish coastline and means a change in fishing methods will be required. There may be new opportunities to capitalise on "new fisheries" but the skills and equipment needed to benefit from opportunities will need to be learned and purchased. As with vegetation on land, aquatic vegetation which is integral to the ecological systems is likely to change which again could have a plethora of unpredictable knock-on effects.

21.1.4. Physical impacts summary

The previous three sections give a very brief outline of the possible outcomes of climate change. The social and economic change stemming from the changes are vast and are included in significant detail in the report produced by the SWCCIP which is available online at http://data.ukcip.org.uk/resources/publications/documents/SW_Tech.pdf.

22. RECOMMENDATIONS FOR FURTHER RESEARCH

Throughout the report there have been several issues regarding the availability of data. In some instances data is not up to date, not comparable with historic data due to changes in data collection methods, the resolution is not suitable for the purpose or in the worst case the data doesn't exist at all. These gaps result in an incomplete evidence base which, ultimately result in decisions being made which could potentially have detrimental effects to the environment, the economy and social wellbeing in Cornwall and the Isles of Scilly. If evidence based policy is to be used, the evidence base must be as thorough as possible. Table 42 below lists data which should be included in the environmental evidence base for Cornwall.

Table 42 - Gap analysis - recommendations for further data acquisition

Sector	Recommendation	Reason
Water – domestic supply	Tourist specific water use per capita including use at various accommodation types.	Accurate data can be used to inform strategic planning for an extended tourist season. Data can also be to monitor sustainable tourism campaigns.
	Identify capacity of sewerage treatment systems. Data may already be held by SWW.	The capacity of sewerage treatment systems must be identified to determine the limits of population growth and demand.
Food	County specific data for food produced including details of exports and food miles.	Food production specific to the County will identify the population size the County alone can support. This is a move towards One Planet living.
	Food consumption data for residents in Cornwall.	Data may support localising food sources. This is a move towards One Planet living.
	Food consumption data for residents in Cornwall.	Data may support localising food sources. This is a move towards One Planet living.
Waste	Tourist specific waste generation per capita including that at various accommodation types.	Tourist specific waste data will help identify the burden the County has to deal with as part of one of its major industries.
	Forecast transport costs for waste transportation to an EfW plant if fuel prices continue to rise.	Forecast costs should be used to ensure plant location and transport fleet is appropriate and financially viable given the rising fuel costs.
Land use and conservation	Provide funding to enable the Land Mapping Project to regularly gather accurate land use data.	There needs to a method to accurately identify land use change and environmental impact of growth and development in the County. The Land Mapping Project can provide this data but requires funding.
Biodiversity	Human resources are required to interpret biodiversity gathered in the County.	Biodiversity data exists for Cornwall but at present cannot be used due to lack of resources to interpret the results. The data will be in conjunction with land use data to identify change and impact in the County.
Generic	Create a "live" and permanently staffed evidence base to compile environmental, economic and demographic data across the County.	Research results are being published at least weekly and much of the data relates to Cornwall. Policy and planning needs an up to date evidence which at present isn't available.

22.1. Scenario modelling

The collection and analysis of historic and current data is fundamental to understanding baseline conditions and trends. There is scope to extrapolate historical data trends to make forecasts but this is generally limited to one variable at a time and interaction with other variables cannot be observed. To simulate various scenarios and the reaction between more than one variable requires the use of modelling tools. Scenario models, as they are called, can be used in a variety of ways but the most common is to inform policy decision making. Extensively used in business and increasingly in environmental sectors, scenario modelling can help identify the necessary actions required to meet targets.

The Intergovernmental Panel on Climate Change (IPCC) has been using scenario models to forecast the impacts of global carbon emissions on climate. It is the output from these models which is shaping many of the policies which are being put in place to try to minimise and if possible avert catastrophic environmental and economic disasters. The forecasts may not also be perfect as the IPCC have demonstrated, the Fourth Assessment report concluded that earlier forecasts had in fact been too conservative, but the forecasts do at least provide an indication as to which way the situation is moving. All forecasts will only be as good as the data used to generate them which is why an accurate and current evidence base is so critical for Cornwall.

Some Local Authorities in Scotland have been using scenario models to reduce their ecological footprint. Using the Stockholm Environmental Institute's Resource and Energy Analysis Programme (REAP), various scenarios have been run to identify a path towards a reduced ecological footprint. The REAP model has also been an excellent tool to engage communities with the issues and necessary actions required to achieve a reduced impact.

What the REAP model isn't able to calculate however is sector specific limits. For example, REAP cannot identify the relationship between traffic growth and the point at which roads exceed their capacity (congested), or when the water demands of a population exceed the supply capacity. Using the data gathered in this report and in the future, scenario models should be employed in Cornwall to:

- Identify the ecological footprint of Cornwall using the REAP model.
- Using sector specific models and the data in this report, identify relationships between growth and impact.
- Using the modelling outputs, develop strategies and policies to first avoid breaching supply thresholds and second reduce impact where the resource is managed in a sustainable way.

22.2. Maintaining an evidence base

If evidence based policy is to be used, the evidence base must be up to date and accurate. Gathering and maintaining new sources of data should be a continual process. New and relevant research is published on a weekly basis and only by regularly reviewing the work can it be fully understood and utilised. To enable a "live" evidence base, there must be investment in the resources required. This would be more cost effective than infrequent reviews of the environmental baseline which are often dependent on uncertain and limited sources of funding. The result would be a resource that is integral to Local Authority operations and would contribute towards the success and development of the County.

23. CONCLUSION

Local Authorities in the UK have been gifted information that 10 years ago would have been expensive to attain. Now, free of charge, any Local Authority (or anyone with access to the internet) can download carbon and ecological footprint data for Local and District Authorities. A quick review of the data will prove that Cornwall and the Isles of Scilly are not the worst performing area in the UK but they aren't the best. Put into a global context, residents in Cornwall and the Isles of Scilly are using approximately threes times the recommended global per capita use. The soon-to-be Unitary Authority must use these data as a benchmark and ensure every year the impact from the County is measurably reduced.

At present, the action to reduce environmental impact is at best, slow. Resource usage in the County is increasing. As stated by the Local Government Association, Local Authorities are uniquely placed to influence change. Gestures such as signing the Nottingham Declaration need to be followed up with genuine actions. Having been slow to react to the issue of climate change and resource depletion, the County can look to more proactive UK authorities for examples of good and effective practice. There are now several of these including all 32 Local Authorities in Scotland.

The physical environmental impacts on the County may in the relative short-term (50 years) not be reversible. However, mitigating against further change *is* possible. As stated in the summary of an earlier section, plans in relation to the environment have to be long-term and they have to be bold. Reducing resource demand and moving to a low carbon lifestyle now, will be a lot easier than an abrupt shift in a few years time. If the world's largest and smartest businesses have recognised the need and economic opportunity for change at the recent UN climate negotiations in Bali, so too can the authorities in Cornwall.

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