

# Stepping Forward

A resource flow and ecological footprint analysis of the South West of England

## Summary report

### The *Stepping Forward* Report Series

This report is one of a series of separate reports produced for the *Stepping Forward* project:

- **Graphic summary** (printed and web)
- **Summary report** (printed and web)
- **Scenarios report** (printed and web)
- **Resource flow report** (web only)
- **Ecological footprint report** (web only)  
(with Ecological footprint analysis results and sustainability assessment)
- **Tourism report** (web only)
- **Technical report** (web only)

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## Biffaward Programme on Sustainable Resource Use

### Objectives

This report forms part of the Biffaward Programme on Sustainable Resource Use. The aim of this programme is to provide accessible, well-researched information about the flows of different resources through the UK economy based either singly, or on a combination of regions, material streams or industry sectors.

### Background

Information about material resource flows through the UK economy is of fundamental importance to the cost-effective management of resource flows, especially at the stage when the resources become 'waste'.

In order to maximise the Programme's full potential, data will be generated and classified in ways that are both consistent with each other, and with the methodologies of the other generators of resource flow / waste management data.

In addition to the projects having their own means of dissemination to their own constituencies, their data and information will be gathered together in a common format to facilitate policy making at corporate, regional and national levels.

More than 30 different mass balance projects have been funded by Biffaward. For more information on the Mass Balance UK programme please visit [www.massbalance.org](http://www.massbalance.org)

## Acknowledgements

The South West England Environment Trust (SWEET) is the Entrust approved Environmental Body which commissioned *Stepping Forward*, with work undertaken by Best Foot Forward Ltd. (also project management) and Energy for Sustainable Development (ESD). The project was funded by Biffaward with a contribution from the South West Regional Development Agency.

### Advisory group

SWEET wish to acknowledge the generous help and support of the project advisory group.

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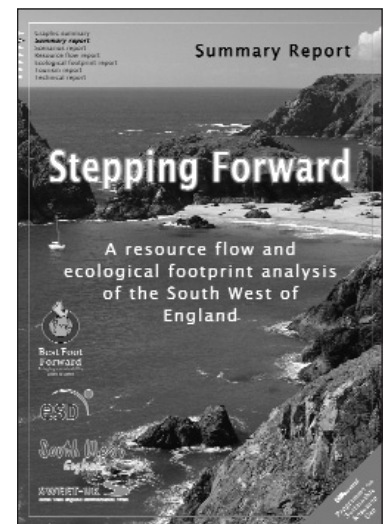
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# Foreword

## South West Regional Development Agency

Many of us would agree that the South West is England's most compelling region - as much a destination for those who seek a great place to live and work as for the nation's holidaymakers. Indeed, our economy is performing strongly; we enjoy an outstanding natural environment; and levels of unemployment in the region are at historically low levels. Nevertheless and despite its successes, the South West faces significant challenges in maintaining and improving quality of life.

One of the clearest challenges is to balance the role of economic development in raising prosperity with the desire to maintain and enhance the natural environment. Some of the tensions arising from this are easily identifiable, not least congestion and the pressure for green-field development. Other impacts of economic activity are less clear, particularly those associated with not only "importing" resources but also exporting waste and pollution beyond the region's boundary.

The Regional Economic Strategy recognises these issues and by identifying the environment as a key driver for future economic success, they are placed at the heart of the region's work to improve its prosperity. However, the absence of robust regional data and intelligence about environmental impacts have been barriers to delivering more sustained economic activity.

This is where *Stepping Forward* comes in. By providing us for the first time with a clear understanding of the region's resource and material flows, together with good quality data, it represents an important step towards a more sustainable South West. The overall message from the report is stark: the region is living significantly beyond its environmental means. It needs to consider urgently how to improve the sustainability of its economic activity and while this will inevitably present challenges, evidence suggests that such robust consideration will also stimulate significant opportunity.

The South West RDA has been pleased to support the development of *Stepping Forward* and we recognise that it is just a first step along what will be, at times, a challenging road. We look forward to playing a full role in disseminating and stimulating discussion on this report and to considering how we can all adapt our activity to support a more sustainable economic future for the South West.




**Juliet Williams**  
Chairman,  
South West Regional Development Agency.

## South West Regional Assembly

The South West is a growing region with a wealth of attributes that continue to attract people into the area. The preservation of what makes the South West desirable must be at the forefront of future development in the region. This principle is at the heart of the South West's Integrated Regional Strategy *Just Connect* which sets out a number of key headline aims and objectives for the region which key regional organisations have endorsed as being critical to the region over the next 20 years.

*Just Connect* recognises the assets of the region - its diversity, its environments, its cultural opportunities, and the balance between its urban and rural parts - and considers them to be key to the South West identity and the attractiveness of the region. But it also acknowledges that many of the environmental assets of the South West are under threat. For this reason, a headline aim of the region is "to enhance our environments and the quality and diversity of our cultural life". The South West Regional Assembly is working with stakeholders from across the region to ensure that this aim, along with the other headline aims of *Just Connect*, are embedded in all future strategies in the region.

Ensuring successful development in the region in the future requires having a clear view of where the region wishes to be and, critically, knowing where we are now. The Regional Assembly welcomes the publication of the Ecological Footprint of the South West, *Stepping Forward*, and considers it to provide some hard-hitting messages for the region about its current resource consumption. This report provides a useful 'back-drop' of information and analysis which is both in-depth and cross-cutting. In making the best use of the available data the report is an important aid in quantifying the likely environmental impacts on the region in the future if our consumption patterns continue at current rates. A welcome key outcome from the report is the identification of the areas that can be most readily addressed in terms of moving towards a more sustainable approach to living in the South West.

The Regional Assembly has been pleased to support the production of this report and will seek to raise its profile amongst the stakeholders of the South West region when undertaking its work and driving forwards the sustainability agenda.




**Chanel Stevens**  
Vice-Chair,  
South West Regional Assembly.

# Chair's statement

One of the challenges of identifying and implementing policies which reduce society's burden on the environment, has been the lack of tools and approaches to define and quantify what is 'sustainable' consumption and what is 'sustainable' production. This study presents two data sets. The Resource Flow Analysis looks at the movement into, within and out of the South West and the use of all natural resources in the South West. This is a powerful tool for quantifying and tracking the resources required (and wasted!) in the production of the goods and services that we enjoy. The Ecological Footprint Analysis looks at the use of resources by the residents of the South West including resources consumed within the South West and indirectly in other parts of the world. It is a resonant and enlightening indicator of the consequences of our consumption patterns and how sustainable those patterns are.

As in several previous studies, these two methodologies have been applied to a region to investigate the ecological aspects of sustainable consumption and production. This study makes a significant step forward by combining these ecological aspects with economic indicators of productivity, costs and savings, and social aspects such as creation of jobs. The scenario work done in this study gives a powerful insight into how these sort of analyses can be used to appraise and provide evidence for local regional and even national policy making.

While there is still a shortage of robust data on which to carry out these analyses, particularly for materials, products and wastes, data sources do appear to be improving. The data we have gives a serious indication that we are already living beyond our means. What we need now are information, data and knowledge to enable us to find effective and efficient ways of living sustainable lifestyles, in terms of both production and consumption. I believe this study makes a useful contribution.

On behalf of the project team I would like to thank those who funded this work and all those who contributed their time and data.



**Sally Campbell**

South West England  
Environment Trust.

Chair of the Stepping Forward Advisory Group.



## The South West region of England

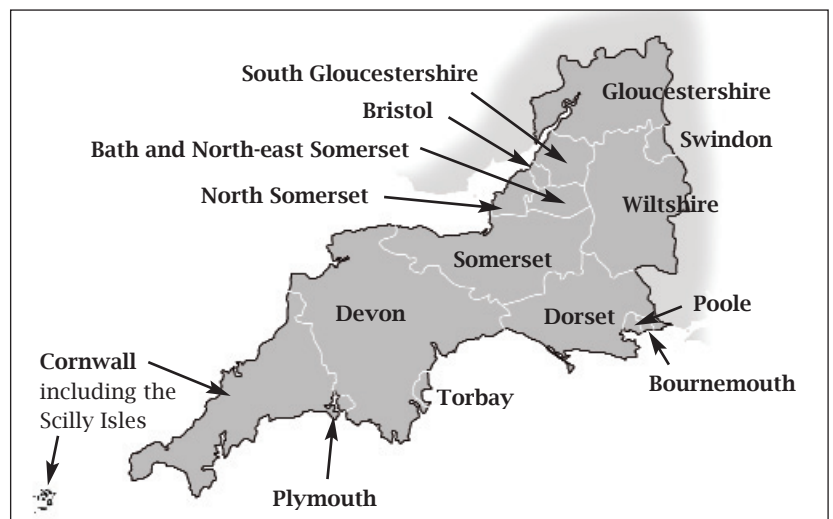
The South West is England's largest and most rural region, covering an area of 23,450 square kilometres (almost 20% of England's total land area). The region has a population of almost five million, with 53% of the population living in rural districts. This is the highest proportion of any region in England.

### The South West is composed of six counties and nine unitary authorities:

**Counties:** Cornwall, Devon, Dorset, Gloucestershire, Somerset and Wiltshire.

**Unitary authorities:** Bath and North East Somerset, Bournemouth, Bristol, North Somerset, Plymouth, Poole, South Gloucestershire, Swindon, Torbay.

Bath, Bristol, Bournemouth and Poole, Cheltenham, Exeter, Gloucester, Plymouth, Swindon, Taunton, Torbay and Weston-super-Mare are the main urban centres.





The South West contributes 8% of the UK's Gross Domestic Product (GDP). The largest contributing sectors are advanced engineering and aeronautics, financial services, food and drink, information and communication technologies, marine engineering and marine activities, telemarketing and tourism and leisure.

Over 2.4 million people are employed in the region. The largest group (26%) work in the distribution, hotels, catering and repairs sector. Expanding sectors include bio- and environmental technology. The region is also well known for its agriculture and mining sectors, however they only account for 1.5% and 0.3% of employment in the region respectively.

The mineral extraction sector is a rich one, with aggregates, coal, oil and gas, and china and ball clay being produced in the region. Fishing is also vital to the economy, with 42% of England's fishing operations based in the region.

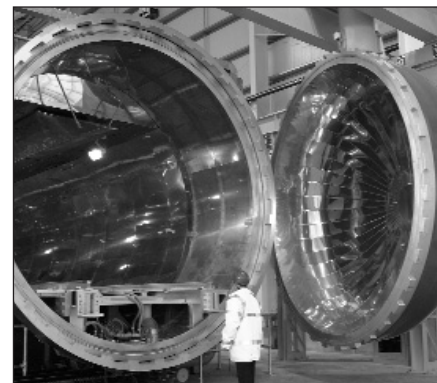
The region's natural beauty, long history and picturesque towns and villages, attract more than 21 million tourists a year, with Land's End (the most southern tip of Great Britain), the Eden Project, the Cotswolds and the Roman Baths in Bath among some of the region's most notable attractions. The South West's natural heritage is one of its strongest assets, with almost 1,126 km of coastline (of which 60% is protected), and 9,830 sq. km. of land dedicated to National Parks, Areas of Outstanding Natural Beauty and the Green Belt. Its two National Parks, Dartmoor and Exmoor, cover 7% of the region's land area.



## The South West, in 2001: Some facts and figures

4.9 million	Population
£13,945	Gross Value Added (in 2002, per person)
23,450 sq. km	Total land area
2.12 million	Households
21.4 million	Tourists
3	World heritage sites
1,509	Conservation areas
6,903	Scheduled ancient monuments
287	Historic parks and gardens
125	Nature reserves
17%	Of England's conservation areas

Sources: Causer & Williams, 2002; South West Observatory, 2004 and SWRA, 2004a.



## A sustainable South West

*...an environment where people benefit from an excellent environment to live and work in, now and for the future...*

(SWRA, 2004a)

In 2001, a regional sustainable development framework was produced to define a vision and to set challenges for achieving sustainable development in the South West (Sustainability South West and SWRA, 2001). This framework was the starting point for the recently released regional environment strategy *Our Environment Our Future*, published by the South West Regional Assembly (SWRA), in association with the South West Regional Environment Network (SWRA, 2004a). This report both recognises the work currently being undertaken to protect and enhance the region's environment and makes recommendations for future opportunities, with an emphasis on integrating the needs of the environment with the economy and society. The strategy lists six key issues concerning the South West's environment:

- **Food, farming and forestry.**
- **Tourism and leisure.**
- **Spatial planning.**
- **Transport.**
- **Climate change.**
- **Wise use of natural resources.**

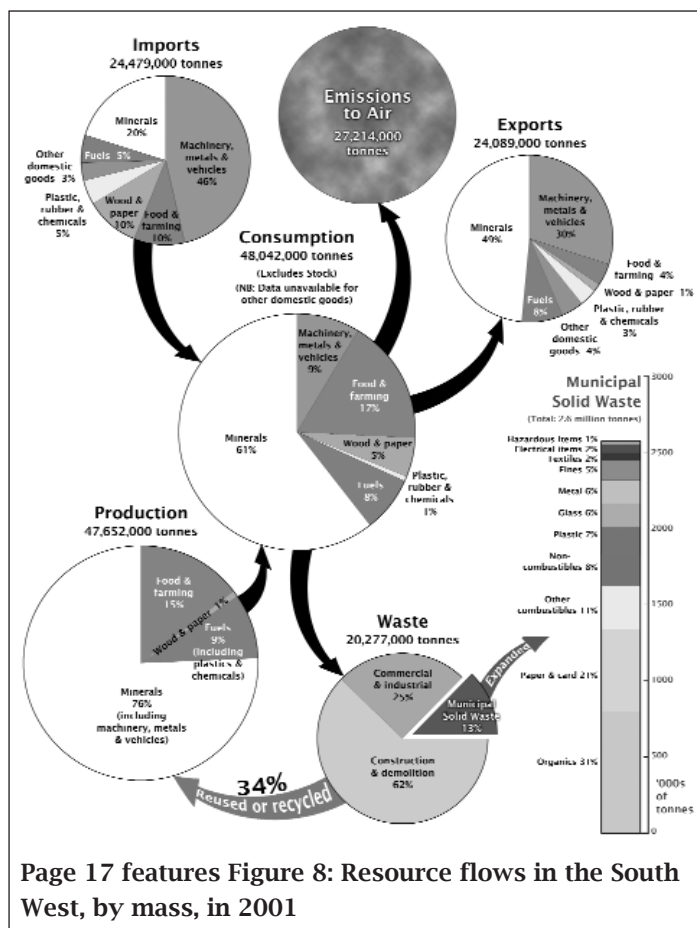
The last two are seen as cross-cutting issues, to be considered in all the other issues. In November 2004, the South West Regional Assembly launched *Just Connect*, an integrated regional strategy for the South West. This is a broad strategy, which sets out a number of objectives and priorities across sectors. Environmental sustainability and the region's environment strategy are seen as key contributors to *Just Connect* and its delivery plan, which will be published in 2005 (SWRA, 2004).

The region has also been involved in campaigns to promote sustainable tourism and construction, which have led to further development of sustainability frameworks and strategies for communities and business (see [www.sustainabilitysouthwest.org.uk](http://www.sustainabilitysouthwest.org.uk) - Sustainability South West).

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# Key findings:

## Stepping Forward Project

### Resource flow analysis

#### In 2001, the South West:

- Consumed 93,760 GWh of energy (including renewable energy).
- Consumed 48 million tonnes of materials and products.
- Manufactured over 17 million tonnes of finished products and consumed approximately 26 million tonnes of products.
- Produced 6.9 million tonnes of food and consumed 3.4 million tonnes of food.
- Generated 20.3 million tonnes of waste, nearly half a tonne of waste for every tonne of resources consumed by the economy.
- Consumed an estimated 3 million megalitres (Ml) of water
- Total physical land area was 2.3 million hectares (ha), of which 50% was grassland.
- Residents travelled an estimated 56 billion passenger kilometres (pass-km), 82% by car and 5% by air.
- Generated 27 million tonnes of emissions to air, of which:
  - 98% was carbon dioxide
  - 45% was associated with road transport.

### Ecological footprint analysis

#### In 2001, in the South West, ecological footprints for:

- Materials and waste were 10.4 million gha - 38% of the total ecological footprint.
- Food was 8.0 million gha - 29% of the total ecological footprint - of which 77% was animal-based food.
- Direct energy was 5.0 million gha - 18% of the total ecological footprint - of which 71% was domestic energy use.
- Personal transport was 2.6 million gha - 10% of the total ecological footprint - of which 79% was car travel.
- Built land was 1.3 million gha - 5% of the total ecological footprint.
- Water was the smallest ecological footprint, 0.05 million gha, (<1% of the total).

*In 2001, the South West residents' ecological footprint was 27.4 million gha (global hectares) or 5.56 gha per person. If everyone on the planet consumed as much as an average South West resident, we would need three Earths to support global resource consumption sustainably.*

### Scenarios

#### Energy

- Domestic energy consumption in the South West was 46,931 GWh with associated CO<sub>2</sub> emissions of 12.6 million tonnes. The majority of this energy was for space heating and water heating.
- In the short term, it is not possible to reduce CO<sub>2</sub> emissions from housing stock through new building strategies, but significant energy efficiency improvements to existing housing stock could reduce CO<sub>2</sub> emissions by 4.4 million tonnes (35%) by 2015.
- A person leading a low-impact lifestyle in a ZED Standard housing development would produce 3.2 tonnes of CO<sub>2</sub> per year, compared with the UK average of 11.1 tonnes.
- The target of 15% electricity from renewables by 2015 is achievable in the South West, but it will require significant new plant. A strategy of constraining consumption growth greatly decreases the requirement for new renewable electricity plant.

#### Waste

- Municipal Solid Waste arisings in the South West in 2001 were 522 kg per person, and Commercial and Industrial waste arisings were equivalent to 1030 kg per person.
- To bring the waste ecological footprint to within the per person earthshare would require a 56% reduction in arisings to 227 kg per person for MSW and 447 kg per person for C&I waste, combined with significant diversion of the waste currently going to landfill.

*Continued opposite...*

## Transport

- The transport ecological footprint of the South West could be reduced by 26% by halving air travel and reducing car travel by 25%.
- If all cars operated at the best fuel efficiency currently available, while still travelling current distances, the transport ecological footprint of the South West would be reduced by 50% and CO<sub>2</sub> emissions would be reduced from 1083 kg to 392 kg per person per year.
- A sustainable level of transport could be achieved by reducing car and air travel by 25% and 50% respectively, and switching all vehicles to hydrogen fuel cells, powered by short crop rotation biomass.

## Tourism

### In 2001, in the South West:

- Tourists spent an estimated £4,535 million.
- Domestic tourists made 24.4 million trips to the region, and overseas tourists made 1.9 million trips, travelling 9.8 billion kilometres to and from the region.
- Over 16,000 accommodation establishments were in operation, of which 60% were Bed & Breakfasts.
- Tourist accommodation consumed 4,512 GWh of energy and 26,109 million litres of water, and generated an estimated 120,000 tonnes of waste

# About *Stepping Forward*

*Stepping Forward* is the first study of the South West's energy and material consumption. The publication of this interesting and engaging series of reports, following 18 months of research, is particularly timely given the recent publication of the Government's new Sustainable Development Strategy (SDS, 2005) which puts sustainable consumption and production at the heart of future policy development.

The aim of the project is to disseminate findings about the South West's environmental impact to a broad audience. It is hoped that this will stimulate well-informed debate, facilitate development of evidence-based policies, support current strategies and illuminate the actions required to achieve a more sustainable future.

*Stepping Forward* gathered and analysed data on resources flowing in, through and out of the South West, from more than one hundred data sources. Key areas of investigation included energy use, material and product consumption, waste management, food consumption, personal transport, water and land use. The *Resource Flow Report* illustrates the flow of primary resources through the region's boundaries and economy and is thus a vital tool for resource management and sustainable economic development.

Data collected in the resource flow analysis was used to calculate the Ecological Footprint of the region and assess the region's ecological sustainability. The *Ecological Footprint Report* highlights the environmental impacts associated with the consumption patterns of the residents of the region. The Ecological Footprint concept quantifies the relationship between resource 'supply' and 'demand' and through this, the environmental sustainability of current consumption patterns.

Future scenarios were also developed looking at a subset of policy-relevant areas; household and renewable energy, biofuels, transport and waste. The scenarios illustrate how changes in policy and practice can affect, to varying degrees, the nature and scale of the resident's ecological footprint.

Small vignettes or 'stories' are presented in the report, illustrating the role played by key sectors in the region such as agriculture, tourism, dairy farming, china clay mining and the aerospace industry. Personal lifestyles are also explored through an assessment of the footprints of some individuals living in the region.

The combination of these analyses makes for compelling reading designed to appeal to a wide range of different audiences. The aim is to foster a better understanding of the environmental impacts associated with activities, both personal and commercial, in the South West.

The resource flow and ecological footprint approach has been tried and tested in similar projects for the Isle of Wight, Greater London, South East England, Scotland, Wales and Northern Ireland. This study builds on these previous works to draw together, more closely, the economic and ecological dimensions of sustainability. In this way it is hoped that *Stepping Forward* will contribute towards a more comprehensive 'roadmap' of future sustainable development.

# Summary report

*Stepping Forward* results are presented in a series of separate reports (see box below), each providing detail on a different aspect of the project. The *Summary Report* draws together key findings from the whole project.

## The *Stepping Forward* Report Series

This report is one of a series of separate reports produced for the *Stepping Forward* project:

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(including the Ecological footprint analysis results and sustainability assessment)
- **Tourism report** (web only)
- **Technical report** (web only)

This study has examined South West activities and their environmental impacts, under the headings of seven main themes or components. Each component is discussed here in terms of consumption, ecological footprint and associated CO<sub>2</sub> emissions, along with any other significant issues. Scenarios for some components examine the effects of changes such as new technology, potential future consumption and the implementation of current government targets of reduction. They take current national and regional targets and best practice into consideration.

### The components covered are:

- Energy
- Materials, products and waste
- Food
- Transport
- Water
- Land use
- Emissions to air.

The results presented here are just an overview of findings from the project. For a more in-depth analysis and methodology description, see the whole series of reports at [www.steppingforward.org.uk](http://www.steppingforward.org.uk).

## What is an ecological footprint?

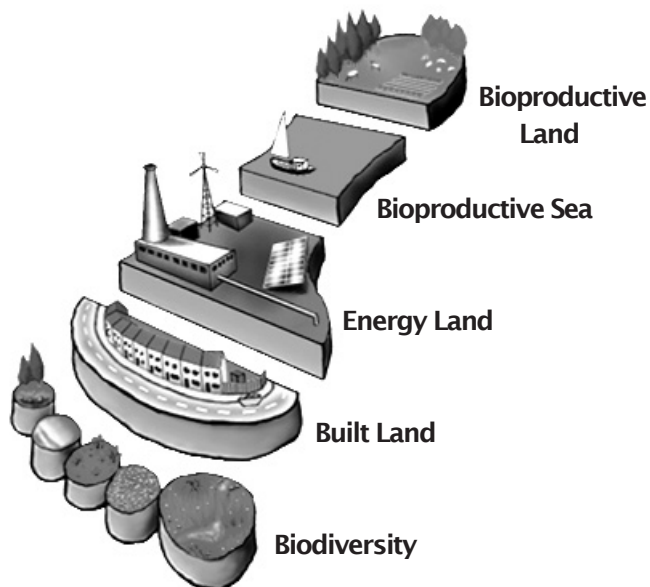
The ecological footprint is a sustainability indicator expressing the relationship between society's consumption of natural resources and the natural environment.

Using area equivalence, it aims to express how much of nature's 'interest' we are currently appropriating. If more bioproductive land and sea is required than is available, then it is possible to assume that the rate of consumption is not sustainable (Chambers *et al.*, 2000).

Alternatively, if everyone lived within their earthshare, we would consume only as much as the planet is able to provide.

As the Ecological Footprint Analysis uses a common currency (global hectare), a broad range of impacts can be aggregated to derive ecological footprints for products, individuals, processes, organisation, regions and countries. It is a 'snapshot' measure and is based on a year-specific data set - 2001 for this study.

**Figure 1: Area types used to calculate an ecological footprint**



## Comparing the resource flow and ecological footprint analysis

It is important to point out how the boundaries used for the Resource Flow Analysis (RFA) differ from the boundaries used for the Ecological Footprint Analysis (EFA). The RFA uses the geographic principle, i.e. it takes into account the flows of resources throughout the region. The EFA uses the responsibility principle, i.e. takes into account the

resources consumed by residents of the South West. For example, the RFA would include consumption impacts of an airport, irrespective of where the airport users lived. The EFA only takes into account the share of the airport's impacts attributable to South West residents.

It is therefore important **not** to assume a direct correlation between data in the RFA and the results of the EFA.

# Sustainable resource consumption and production

## Ecological footprinting as the link between resource efficiency and sustainable consumption

### 'Sustainable' production

The ecological footprint is proving to be a compelling indicator of sustainable consumption. It has two key features that make it so powerful:

- It aggregates consumption of a wide range of resources (both energy and materials).
- It can be used to compare resource consumption (the ecological footprint) with globally available resources (the earthshare) to illustrate what level of consumption is sustainable.

### Can ecological footprinting also be an indicator of 'sustainable' production?

The ecological footprint can effectively be used to aggregate the impact of resources consumed in the production process to provide a *resource efficiency* metric per unit of production. It is possible to compare the ecological footprint of 'product A' with 'product B' or with the per person average earthshare. It is also possible to show how much of the ecological footprint per person is attributable to the consumption of 'product A'. But, while a company or product may be increasingly eco-efficient, no single product or company can, in itself, be sustainable.

#### Sustainability is a function of:

- a) Impacts from all activities of all populations
- b) Impacts throughout the lifecycle
- c) Comparison of all those impacts with available resources.

All of these factors must be taken into account when analysing sustainability. So, the ecological footprint can be a useful resource efficiency metric, but sustainability does not apply to production, only to consumption.

## Resource efficiency

### Can ecological footprinting be used to indicate the most resource efficient way of manufacturing a product?

By including a wide range of energy and material resources, ecological footprinting can be used to compare the aggregate resource efficiency of producing similar products. Perhaps two comparable nappies use differing amounts of wood fibre and plastics. Ecological footprinting can indicate which one, overall, is the most resource efficient. This can be useful in identifying and encouraging best practice in resource efficiency, or in responsible procurement. This should be of interest to policy makers and business at the regional, national and global levels.

### Can ecological footprinting be used to indicate the most resource efficient way of providing a service?

By accounting impacts throughout the lifecycle (in production and use) and normalising them to 'service units', ecological footprinting can indicate the most resource efficient way of providing a service, for example, travel by car. Ecological footprinting can be applied to the manufacture of the car providing the travel services.

For example, the direct energy used to build a Honda, in Swindon in 2001, had an ecological footprint of 0.17 gha<sup>1</sup>, but the footprint of the energy consumed in manufacture was about 6% of the energy consumed throughout the lifecycle of the car, assuming average South West use. The ecological footprint relating to the use of the vehicle is therefore the most significant element.

### Can ecological footprinting be used to indicate the most resource efficient way of creating economic wealth?

Ecological footprinting can be used alongside economic indicators such as GDP or GVA, to estimate the most resource efficient way of generating economic wealth. For example, the tourism industry in the South West has an annual ecological footprint of 2,036,375 gha and generates £2,439 million of GVA. (£1,198/gha). The motor manufacturing plant run by Honda in the South West has an estimated ecological footprint of 296,101 gha, and generated an estimated £160 million of GVA (about £542/gha).

This is of interest to economic development agencies charged with encouraging industries with low resource intensities within their economic base. However, it should be noted that if society continues to consume products and services with higher resource intensities, these must be manufactured somewhere. There is always the possibility that although a population sources low intensity products from the domestic economy, it will source high intensity products from elsewhere - the impacts are still incurred, but have been exported - a process sometimes referred to as 'burden shifting'. As sustainability is a global property, this approach will not improve the overall sustainability.

### Can ecological footprinting be used to assess whether a product or service, business or sector is 'sustainable'?

A product or service cannot be defined as 'sustainable' in itself, but the ecological footprint can be used to indicate whether the resource efficiency of a product or company is improving or declining. Ecological footprinting can also determine the contribution of a product or service to overall resource consumption. For example, services provided by the NHS in England and Wales were responsible for 2% of the total ecological footprint per person in 2001, and 5% of the average earthshare. Clearly it is necessary to apply ecological footprinting across all activities to enable this comparison.

<sup>1</sup> Calculated based on data from Honda's *Safety & Environment Report* (Honda, 2001).

# How sustainable is the South West?

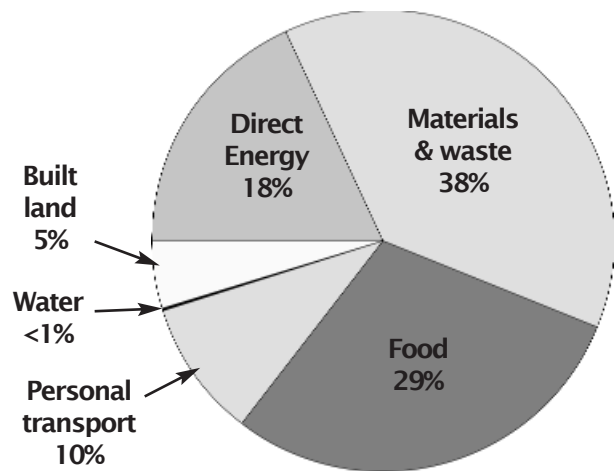
One of the benefits of using ecological footprinting as a metric is its ability to link the personal with the global and make the link between what we consume (the per person footprint) and the ecological limits of the planet (the average 'earthshare'). It enables an assessment of the sustainability of a given population.

The South West residents' ecological footprint for 2001 was 5.56 gha per person. If everyone on our planet consumed as much as the average South West resident, we would need 3 Earths to support our current lifestyles sustainably.

The average 'earthshare' is 1.9 gha (Chambers *et al.*, 2000). To bring South West residents within the earthshare would require a reduction of 66% in their current ecological footprint.

Figure 2 shows the components of the South West resident's ecological footprint. 'Materials and waste' was the most significant component, 38% of the total, and food was the second largest at 29%.

**Figure 2: Total ecological footprint for a South West resident, by component, in 2001**



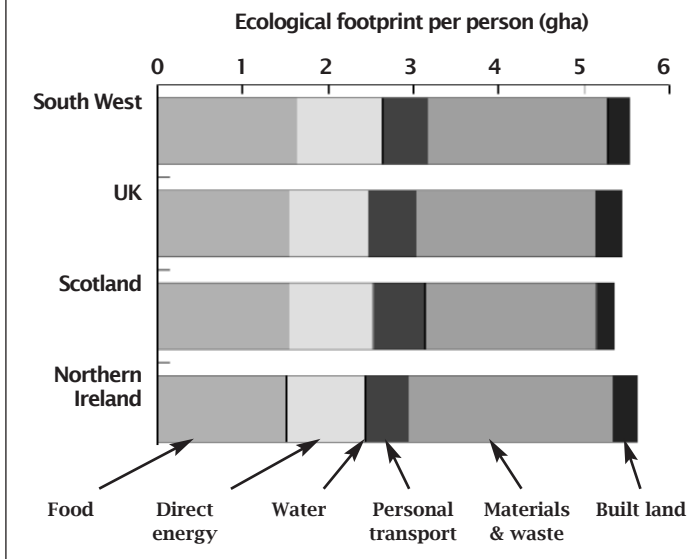
## Comparing the South West to other UK regions

Figure 3 compares a South West resident's ecological footprint to UK, Northern Ireland and Scotland averages. A South West resident has, on average, the highest direct energy ecological footprint. This is due to the large quantities of brown-grid electricity consumed in the region.

The environmental impacts associated with food consumption in the South West were also slightly higher than for other regions. This is because the average South West resident consumes 5% more food (698 kg per year, against the UK average of 668 kg), and this has a slightly higher animal content (40% against 38%).

The South West personal transport footprint is lower than the UK average; higher car use is counterbalanced by lower air travel.

**Figure 3: Comparison of a South West resident's ecological footprint, with other UK regions, by component, in 2001**



## CO<sub>2</sub> emissions

For the South West in 2001,

- 'Production' CO<sub>2</sub> emissions were calculated as 26.6 million tonnes - 5.4 tonnes per person. Road transport was responsible for about 45% of the emissions to air.
- 'Consumption' CO<sub>2</sub> emissions were calculated as 56.6 million tonnes - 11.6 tonnes per person. (See Table 1).

The difference between production and consumption illustrates the reliance of the South West (and indeed the UK) on economic activity, with the associated CO<sub>2</sub> emissions, occurring elsewhere.

**Table 1: Consumption-based CO<sub>2</sub> emissions for the South West, in 2001**

	kgCO <sub>2</sub> /person
<b>Total</b>	<b>11,553</b>
<b>Nourishment</b>	<b>555</b>
<i>of which...</i>	
plant	228
animal	327
<b>Shelter</b>	<b>2,665</b>
<i>of which...</i>	
domestic electricity	1,338
domestic natural gas & LPG	1,039
domestic oil	161
domestic coal	128
renewables (excl. wood)	0
other domestic	0
<b>Mobility</b>	<b>1,815</b>
<i>of which...</i>	
car	1,570
bus & coach	18
rail, tram, metro etc.	33
waterborne	56
air travel	126
motorbikes/scooters	12
<b>Goods</b>	<b>4,442</b>
<i>of which...</i>	
landfilled	4,141
recycled/composted/other	301
<b>Services</b>	<b>954</b>
<b>Construction</b>	<b>1,122</b>

**Source:** Best Foot Forward Regional Stepwise™ model  
**Note:** Nourishment relates only to agriculture and excludes CO<sub>2</sub> emissions relating to food packaging, processing or distribution (which are included in 'Goods').  
**Note:** The calculations for goods assume the embodied energy and associated life cycle emissions for each kg of municipal waste to be 9.7 kg CO<sub>2</sub> per kg (landfilled) and 3.9 kg CO<sub>2</sub> per kg (diverted waste). The former figure is based on national UK averages including net imported materials.  
**Note:** Freight is included in 'Goods'.

**Table 2: Direct energy consumed in the South West, by fuel type, in 2001**

	Total direct energy (GWh)	% of total direct energy	Sector	
			Domestic	Non-domestic
<b>Total energy</b>	<b>93,760</b>		<b>46,931</b>	<b>46,704</b>
<i>of which...</i>				
Electricity*	32,710	35%	13,967	18,743
Gas	46,030	49%	27,969	18,061
Solid fuel***	3,865	4%	1,909	1,956
Petroleum	11,030	12%	3,087	7,943
Heat energy+	125	<1%	**	**

\* Includes 375 GWh of electricity generated in the South West from renewable sources.  
 \*\* No data available.  
 \*\*\* Solid fuel includes coal.  
 + This is heat energy from landfill gas, solar panels and biomass.  
**Note:** Totals may differ due to rounding.  
**Note:** The petroleum figure reported does not include petroleum used for transport.  
**Sources:** AEAT, 2001 & 2003; DEFRA, 2003b; DETR, 1996; DTI, 2002, 2003 & 2003a, 2004 & 2004a; Mitchell & Regen, 1998; ODPM, 2001; ONS, 2003a & 2003b; REWARD, 2004; Transco, 2003 and Western Power, 2004.

# Energy

This component covers energy consumed in the South West in 2001, for purposes such as power, heating and lighting.

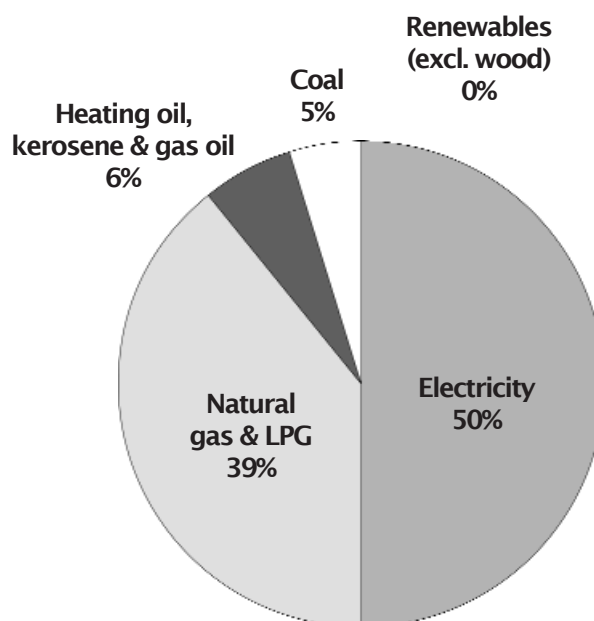
In 2001, the South West consumed an estimated **93,760 GWh of energy**, of which 49% was from gas. It generated 500 GWh of renewable energy, of which 375 GWh was in the form of electricity. The manufacturing sector consumed more than 60% of all industrial energy. Over half the energy used in homes went to space heating. Table 2 shows energy consumption by fuel type.

## Energy ecological footprint

The direct (domestic and services) energy ecological footprint in 2001 was 1 gha per person, 18% of the total ecological footprint.

Domestic energy accounted for 71% of the footprint. Domestic electricity consumption had the largest impact, 35% of the total energy footprint, 50% of the domestic energy footprint. Domestic natural gas & liquid propane gas (LPG) consumption had the second largest impact at 28% of the total energy footprint, 39% of the domestic energy footprint. Figure 4 shows the domestic energy footprint by fuel type.

**Figure 4: The domestic energy ecological footprint of a South West resident, by fuel type, in 2001**



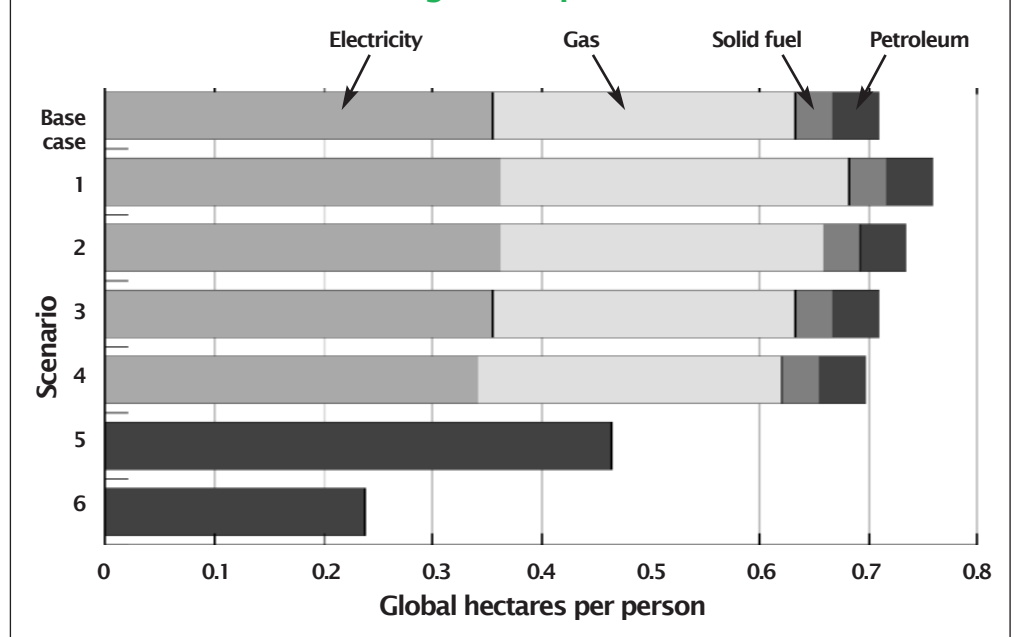
## Direct energy scenarios

### Housing and domestic energy

In 2001, there were 2,186,000 dwellings in the South West of England (ONS, 2003b). Total domestic energy consumption was approximately 46,931 GWh. This corresponds to over 12.6 million tonnes of CO<sub>2</sub> emissions.

The scenarios presented here illustrate the relative importance of addressing energy consumption in the South West's existing housing stock and new build. Figure 5 shows the ecological footprints for six scenarios of domestic energy use in the region.

**Figure 5: Housing and domestic energy base case and scenario ecological footprints for the South West**



#### Housing and domestic energy scenarios:

- 1: all new homes in the South West are built to current minimum requirements i.e. *Building Regulations 2002*.
- 2: all new homes are built to higher than current energy efficiency standards.
- 3: all new homes in the South West are built to Zero Energy Development (ZED) Standards.
- 4: no energy efficiency measures are installed in existing houses, but technology improvements are implemented between 2001 and 2015.
- 5: selected energy efficiency measures are installed in existing buildings between 2001 and 2015.
- 6: further measures required to reach a one planet lifestyle for domestic energy use in existing buildings by 2015.

For more details see the housing and domestic energy scenarios in the *Scenarios Report* in print or at [www.steppingforward.org.uk](http://www.steppingforward.org.uk).

### Renewable electricity

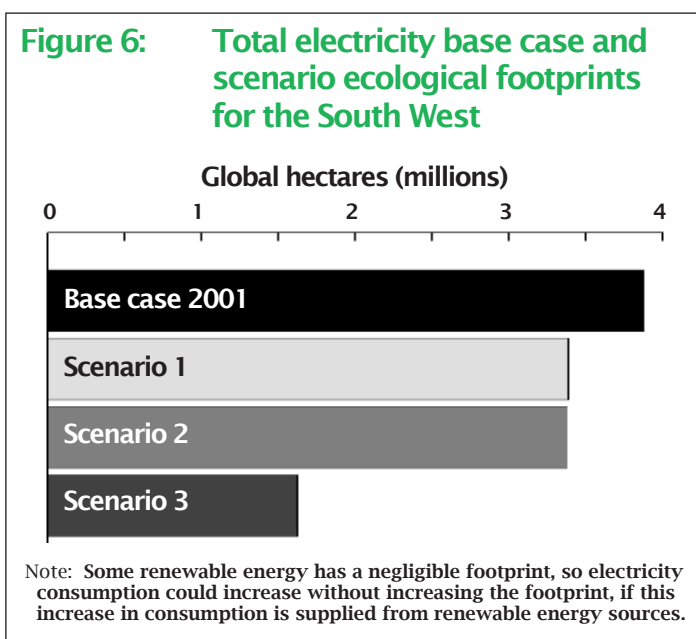
In 2001, just over 1% of electricity consumed in the South West was generated from renewable sources. The UK Climate Change Programme expresses an aim for renewables to supply 10% of UK electricity by 2010 and the government's *Renewables Obligation* includes a target of 15.4% of renewable electricity by 2015 (DTI, 2004b). The *Energy White Paper* also emphasises the importance of real progress, highlighting an aspiration to achieve 20% renewables by 2020 (DTI, 2003b). A target of 11-15% by 2010 was specified for the South West in *REvision 2010* (GOSW & SWRA, 2004).

The South West should be able to achieve 11-15% of electricity generated from renewable sources by 2010. Scenarios illustrated in Figure 6 show some possible strategies for achieving this target, and the ecological footprints associated with them. For more detail on the scenarios, and discussion of the costs and benefits associated with renewable energy options in terms of investment, job creation and land use, see the *Scenarios Report* in print or at [www.steppingforward.org.uk](http://www.steppingforward.org.uk).

#### Renewable electricity scenarios:

- 1: extending the *REvision 2010* proposed renewable electricity mix for 2010 (GOSW & SWRA, 2004) to a 15% renewable electricity target by 2015.
- 2: using a different mix of renewable technologies to meet the extended 15% renewable energy target by 2015.
- 3: measures required to reach a one planet lifestyle by 2015, from electricity supplied in the South West.

**Figure 6: Total electricity base case and scenario ecological footprints for the South West**



## Landrake eco-housing case study

Cornwall Sustainable Building Trust ran a competition to find 'novel and sustainable solutions' to the problem of affordable housing. The competition winner, architect Bill Dunster, proposed a Zero Energy Development (ZED) Standard development, to reduce a broad range of environmental impacts relating to water use, transport, waste, food supply and material consumption (bdaZEDfactory, 2004).

Dunster's design reduces energy demand through super insulation and massive construction<sup>1</sup>, maximising solar gain, and incorporating passive cooling.

There are on-site renewable energy sources: a communal woodchip boiler, two wind turbines, solar water heating panels, and photovoltaics. Rainwater collection, storage and recycling are combined with water-efficient fittings to reduce water consumption.

Designed to be both affordable and environmentally benign, while providing a high quality of life for residents, the Landrake development is ideal to illustrate the potential for sustainable new build in the South West.

Using data from the Dunster-designed BedZED development, the prototype for the ZED Standards, we can explore the ecological footprints for future Landrake residents with reference to the South West average for residents moving into new build.

Living in a Landrake development, a person leading a consciously sustainable lifestyle could have an ecological footprint as low as 2.11 gha with CO<sub>2</sub> emissions of 3.2 tonnes, compared to the South West average of 5.6 gha and 11.6 tonnes CO<sub>2</sub>.

For more detail on the Landrake case study, see the *Scenarios Report* in print or at [www.steppingforward.org.uk](http://www.steppingforward.org.uk).

<sup>1</sup> Massively constructed buildings store heat during the day for slow release at night (or over even longer periods) to minimise the need for supplementary heating. Absorbing heat in this way can also reduce overheating on hot days.

## Personal lifestyles, personal footprints

To cast light on some personal lifestyles in the region, several volunteers living in the South West calculated their own ecological footprints using Personal Stepwise™. Although the group of volunteers is in no way intended to be representative of the South West, the results demonstrate how individuals' everyday activities and decisions impact on the environment, and show the complexity of decisions we make everyday - balancing our quality of life with our ecological footprints.

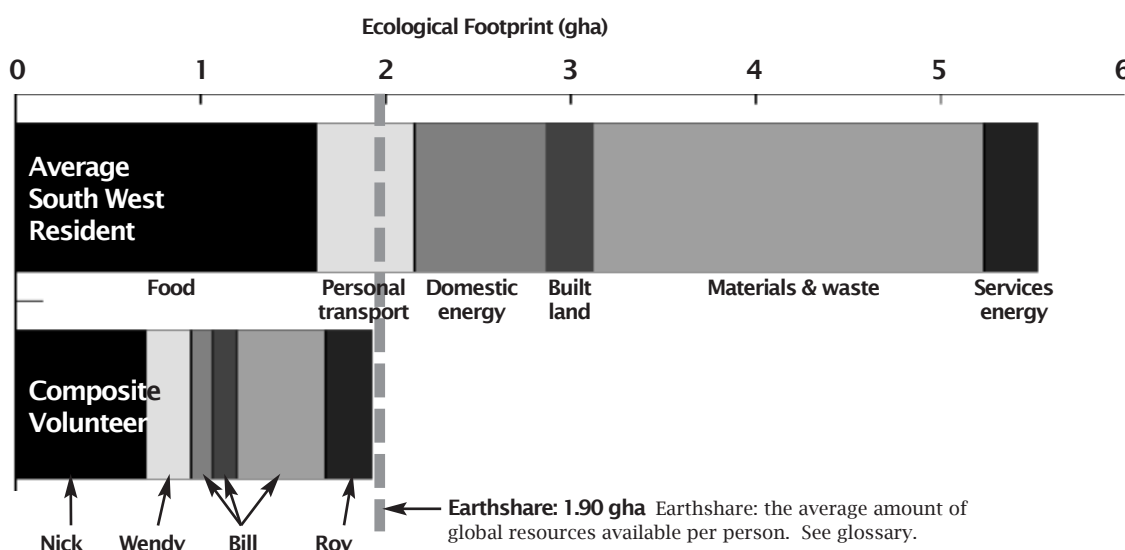
Our volunteers' responses highlight some important issues for people in the South West. For example, decisions about car use are driven by availability of public transport and the need to travel to and from work. Food, too, was highlighted, with several people mentioning locally produced animal products. As is seen in the section on food, a slightly higher consumption of animal products raised the South West food footprint above the national average.

Combining low values from several volunteers, it is possible to create a composite footprint close to average earthshare (see Figure 7). Although none of the volunteers

has a one planet lifestyle, several of them have at least one footprint component at a near-sustainable level. This suggests that in principle a sustainable lifestyle is achievable, even in the UK.

The complete Personal Lifestyles vignette can be seen in the *Ecological Footprint Report* at [www.steppingforward.org.uk](http://www.steppingforward.org.uk).

**Figure 7: A sustainable lifestyle ecological footprint produced by combining results from volunteers**



## Materials, products and waste

In 2001, the South West consumed over **42.7 million tonnes of materials**. These materials were either consumed directly (in their 'raw' form), for example fresh vegetables sold to a restaurant, or used in the processing and manufacture of other products, for example china clay for the production of paper.

Mining and quarrying of materials such as sand, clay and metal ores dominated production (which also includes extraction), accounting for 76% of total production in the region. Figure 8 shows material and product flows through the South West, in 2001.

## Materials, products and waste ecological footprint

This component includes all the materials and products consumed in the South West, which are not accounted elsewhere: for example, impacts relating to the manufacture of passenger vehicles are accounted in the 'personal transport' ecological footprint so do not appear here. This component also includes the ecological footprint of waste, as materials and products eventually end up in the waste stream.

**The ecological footprint for materials and waste in 2001 was 2.11 gha per person, and accounted for 38% of the total ecological footprint.**

Breaking down the materials, products and waste ecological footprint by resource use, 81% of the footprint is associated with embodied energy, i.e. the energy used from all sources during the entire life cycle for manufacturing, transporting, use and disposal.

## The china clay industry

The South West is one of the world's leading producers of china clay (or kaolin). About 75% is used in the manufacture of paper, of which 80% is exported abroad. China clay is used in the manufacture of porcelain, tiles, paint, rubber and plastics. It can also be found in leather, textiles, medicine and as an anti-caking agent in fertilizers and insecticides. 87% of china clay produced is exported, mainly to Europe.

A significant amount of waste is produced during the process of turning china clay from its raw form into a marketable commodity. It is estimated that for every tonne of pure clay recovered, approximately nine tonnes of waste is generated, consisting mainly of quartz, sand and rock. Due mainly to the introduction of the *Aggregates Levy*<sup>1</sup> in 2002, companies have had to look for a market for this 'waste', most being sold on as secondary aggregate in the South West region. However, there is a large market yet to be exploited, with an estimated UK demand for 380 million tonnes. Table 3 shows the flow of materials and waste associated with the china clay industry in the South West in 2001.



A china clay mine near St Austell, Cornwall.

**Table 3: Material flows associated with the china clay industry through the South West, in 2001**

	('000 tonnes)			
	Imports	Production	Consumption	Exports
China clay	95	2,204	371	1,930
China clay waste	*	19,840	*	*

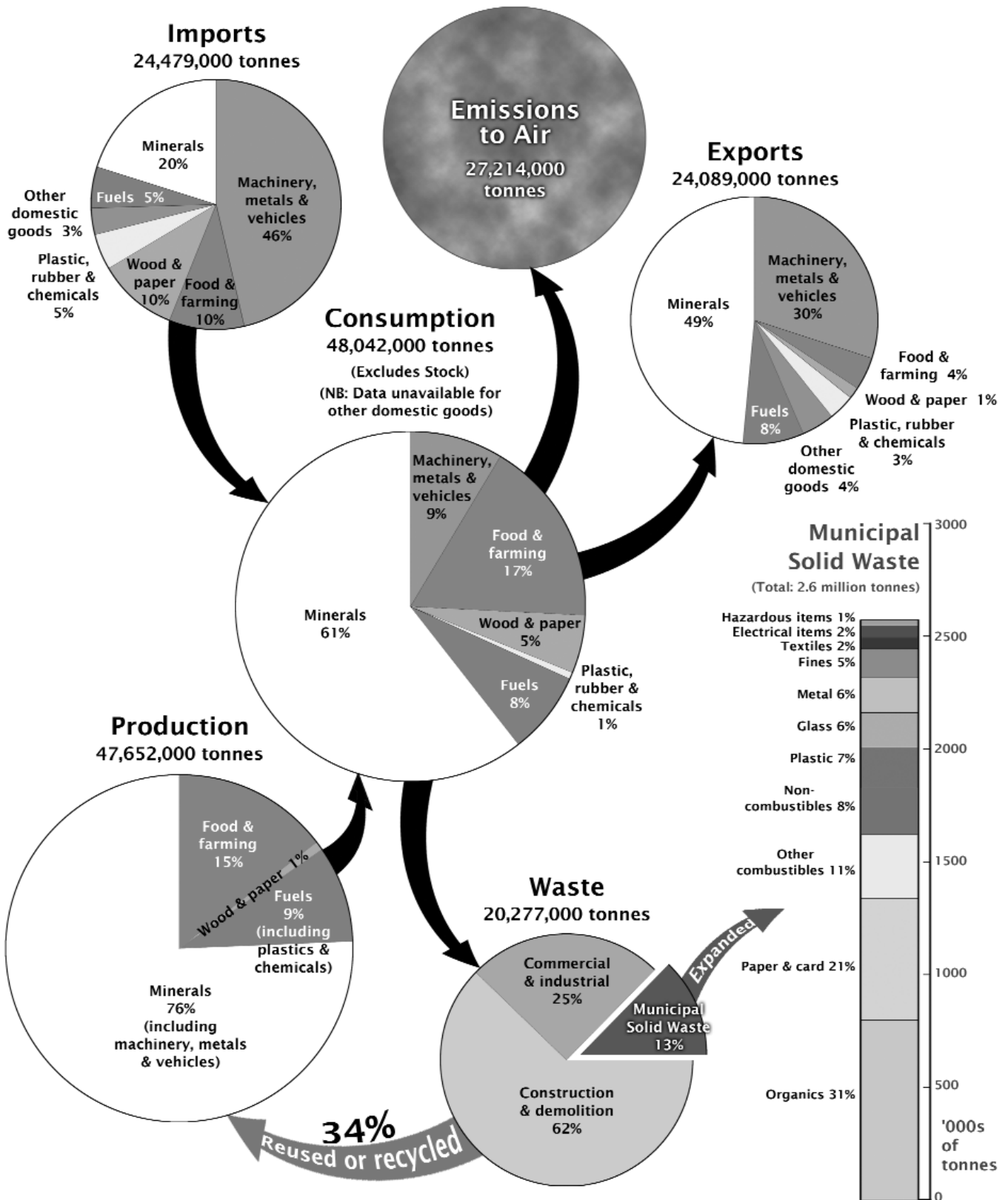
\* No data available.

<sup>1</sup> An environmental tax on the commercial exploitation of aggregate in the United Kingdom. The levy aims to bring about environmental benefits by making the price of aggregates better reflect the costs of extraction, and encouraging the use of alternative materials such as recycled materials and certain waste products (HM Customs & Excise, 2002).

**Sources:** BGS, 2002; CHAIN, 2004; China Clay Museum, 2004; Cornwall UK, 2004; Dartmoor National Park, 1998; DEFRA, 2002a; ENDS, 2004; ODP, 2004; Scottish Executive, 2003 and The Potteries, 2004.

Breaking down the footprint by consumption mode, 36% (0.76 gha) of the footprint is associated with municipal solid waste, and 54% (1.13 gha) with commercial & industrial waste. Waste is examined in more detail here, and a more detailed breakdown of the materials, products and waste ecological footprint is provided in the *Ecological Footprint Report* at [www.steppingforward.org.uk](http://www.steppingforward.org.uk)

**Figure 8: Resource flows in the South West, by mass, in 2001**



Note: Totals may differ due to rounding.  
 Note: Data unavailable for other domestic goods including furniture, leather goods, other clothing and electronic items.  
 Note: Imports + Production - Exports = Apparent Consumption.  
 Note: Production only accounts for materials and excludes products in order to avoid double counting.

Note: Emissions to air include CO<sub>2</sub>, CO, VOCs, NO<sub>x</sub>, SO<sub>2</sub>, NH<sub>3</sub>, PM10, HCl, Benzene, 1,3 Butadiene and heavy metals.

Sources: BGS, 2002; Bringezu & Shutz, 2001 & 2001a; DEFRA, 2002, 2003 & 2003c; FAO, 2002; Forestry Statistics, 2003; Highley *et al.*, 2003; ONS, 2001a & 2003a and University of Plymouth, 2003.

# Waste

In 2001, the South West generated **20.3 million tonnes of waste** (just over 4 tonnes per person) of which:

- 2.6 million tonnes (522 kg per person) was Municipal Solid Waste (MSW), of which 97% was household waste.
- 5 million tonnes was Commercial & Industrial (C&I) waste.
- 12.6 million tonnes was Construction & Demolition (C&D) waste.

Table 4 shows a breakdown of waste generated in the South West in 2001, by sector and waste type.

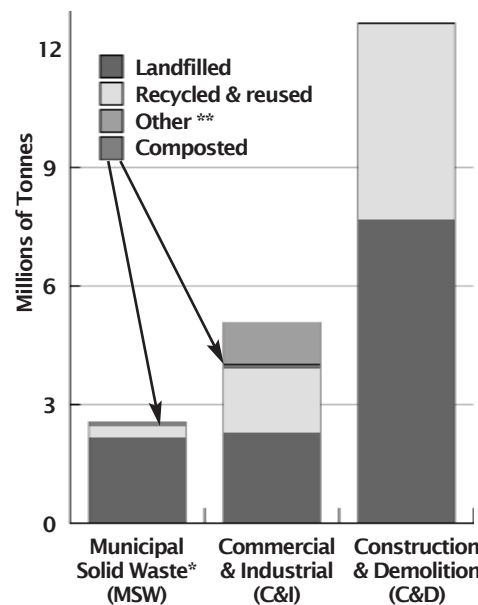
31% of MSW was organic waste, which is likely to include food and garden waste, and 21% was paper and card.

Construction and demolition (C&D) at 12.6 million tonnes made up 62% of total waste generated in the South West. Concrete was the largest category at 23%, and inert waste such as bricks, rubble and sand made up the second largest category, at 18%.

## Waste management

The majority of waste generated in the South West in 2001, was sent to landfill (12.1 million tonnes), with 5.2 million tonnes recycled (26% of total waste generated). The best recovery (recycling and reuse) rate was achieved by the C&D sector, at 39%. The C&I sector had a recovery rate of 32%. In both cases recycling was relatively high at 28% and 27% respectively. In comparison, only 11% of MSW was being recycled. Figure 9 compares the waste management methods used for MSW, C&I and C&D waste in the South West in 2001.

**Figure 9: Comparison of management methods used for waste generated in the South West, by sector, in 2001**



\* Includes 3,000 tonnes incinerated, including energy from waste.  
 \*\* Other includes waste management methods such as thermal treatment and transfer.

Sources: Environment Agency, 2000a; Environment Agency & RTAB, 2004; Poll, 2003; Reid, 2003 and Symonds Group, 2003.

**Table 4: Waste generated in the South West, in 2001, by sector and waste type**

Municipal Solid Waste (MSW)	Total ('000 tonnes)	% of total MSW	Commercial & Industrial (C&I)	Total ('000 tonnes)	% of total C&I	Construction & Demolition (C&D)	Total ('000 tonnes)	% of total C&D
<b>Total</b>	<b>2,574</b>	<b>100%</b>	<b>Total*</b>	<b>5,083</b>	<b>100%</b>	<b>Total</b>	<b>12,620</b>	<b>100%</b>
<i>of which...</i>			<i>of which...</i>			<i>of which...</i>		
Organics+++	798	31%	General***	2,586	51%	Concrete	2,896	23%
Paper & card	540	21%	Other general & biodegradable+	795	16%	Inert	2,215	18%
Other combustibles	283	11%	Paper & card	477	9%	Packaging	1,979	16%
Non-combustibles	206	8%	Chemical & other	368	7%	Timber	1,426	11%
Plastic	180	7%	Metals & scrap equipment	291	6%	Plastic	1,178	9%
Glass	154	6%	Contaminated general	280	6%	Asphalt (demolition)	947	8%
Metal	154	6%	Food	242	5%	Other++	915	7%
Fines**	129	5%	Mineral wastes & residues	44	1%	Metal	522	4%
Textiles	51	2%				Plaster & cement	196	2%
Electrical items	51	2%				Ceramic (construction)	189	2%
Hazardous items	26	1%				Insulation (construction)	158	1%

\* The Environment Agency's (2000a) original C&I total (5.2 million tonnes) included some C&D waste. This has been removed, as it was accounted for in the C&D waste.

\*\* Fines include dust, ash and cinders.

\*\*\* General waste includes tyres, Waste Electric & Electronic Equipment (WEEE), fluorescent tubes and lamps.

+ General and biodegradable waste includes wood waste, plasterboard, rock and soil.

++ Other C&D includes demolition, ceramic and insulation waste, and construction asphalt waste.

+++ Organics include food, kitchen and garden waste.

Note: Totals may differ due to rounding.

Note: Due to data limitations, it was not possible to categorise the different waste types into the same categories for all three sectors.

Sources: Environment Agency, 2000a; Environment Agency & RTAB, 2004; Poll, 2003; Reid, 2003 and Symonds Group, 2003

## Waste scenarios

Waste has become one of the most important environmental issues on the political agenda. National targets have been established for industrial and commercial waste (DEFRA, 2000), and numerous targets have been set for municipal solid waste (MSW), mainly related to recycling and recovery. The *Waste Strategy 2000* (DEFRA, 2000) describes a vision for improved management of waste and resources. It sets out the changes needed to deliver more sustainable development, providing the framework for regional and local government to prepare integrated waste management strategies.

In 2003, the South West Regional Assembly (SWRA) published a two-part technical report entitled *Developing a Regional Waste Strategy for the South West Regional Assembly* (SWRA 2003a and 2003b), which led to the publication of *From Rubbish to Resource: The Regional Waste Strategy for the South West 2004-2020* in October 2004 (SWRA, 2004). These reports examine, among other things, future projections of waste trends, and various options for waste management. Figures 10 and 11 show ecological footprints for several waste management scenarios based on the options outlined in the Regional Waste Strategy reports.

## Municipal Solid Waste

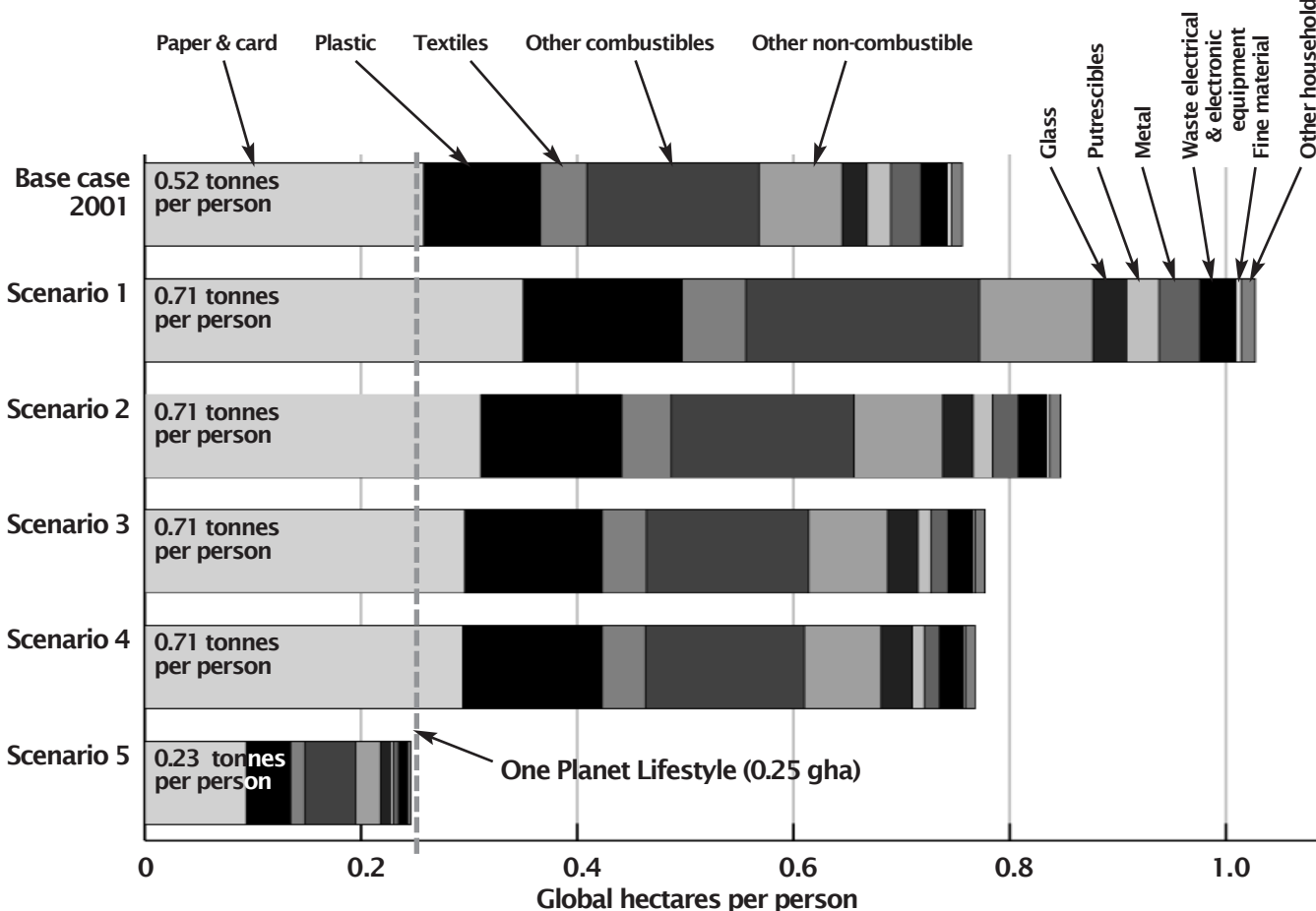
MSW accounted for less than 13% of all waste produced in the South West, but contributed 35% to the materials and waste ecological footprint, 13% of the total South West residents' ecological footprint.

**The ecological footprint of MSW in the South West in 2001 was 0.76 gha per person.**

### Municipal solid waste scenarios:

- 1: no change in current MSW production and management. In 2020, 85% of waste is landfilled, 15% is recycled or composted and 0.1% is used to produce energy (SWRA, 2003b).
- 2: waste management is based on option 5, SWRA's best score for sustainability. By 2020, no waste is landfilled, 45% is recycled or composted and 55% is used to produce energy (SWRA, 2003b).
- 3: waste management is based on SWRA option 4c with increased recycling and composting, mechanical biological treatment and waste to energy. By 2020, 6% of waste is landfilled, 67% is recycled or composted and 28% is used to produce energy (SWRA, 2003b).
- 4: waste management is based on SWRA option 2 with exceptionally high levels of recovery. By 2020, 25% of waste is landfilled, 75% is recycled or composted and no waste is used to produce energy (SWRA, 2003b).
- 5: achieving a one planet lifestyle level of waste management through much reduced waste arisings and exceptionally high levels of recovery.

**Figure 10: Municipal solid waste base case and scenario ecological footprints for the South West, in 2020**



## Commercial and Industrial Waste

In 2001, C&I waste accounted for 25% of total waste generated in the South West (Environment Agency, 2000a), compared to MSW (13%). It accounted for approximately 54% of the materials & waste ecological footprint in 2001, 20% of the total South West resident's ecological footprint.

The ecological footprint of C&I waste in the South West in 2001 was 1.13 gha per person.

### Commercial and industrial waste scenarios:

- 1: no change in current C&I waste production and management in the South West. In 2020, 56% of C&I waste is sent to landfill, 31% is recycled or composted, 9% is used to produce energy and 5% is re-used (SWRA, 2003a).
- 2: meeting the target to reduce landfill to 85% of the 1998 level by 2005 (GOSW & DTLR, 2003). In 2020, 47% of C&I waste is sent to landfill, 33% is recycled or composted, 9% is used to produce energy and 11% is re-used (SWRA, 2003a, 2003b).

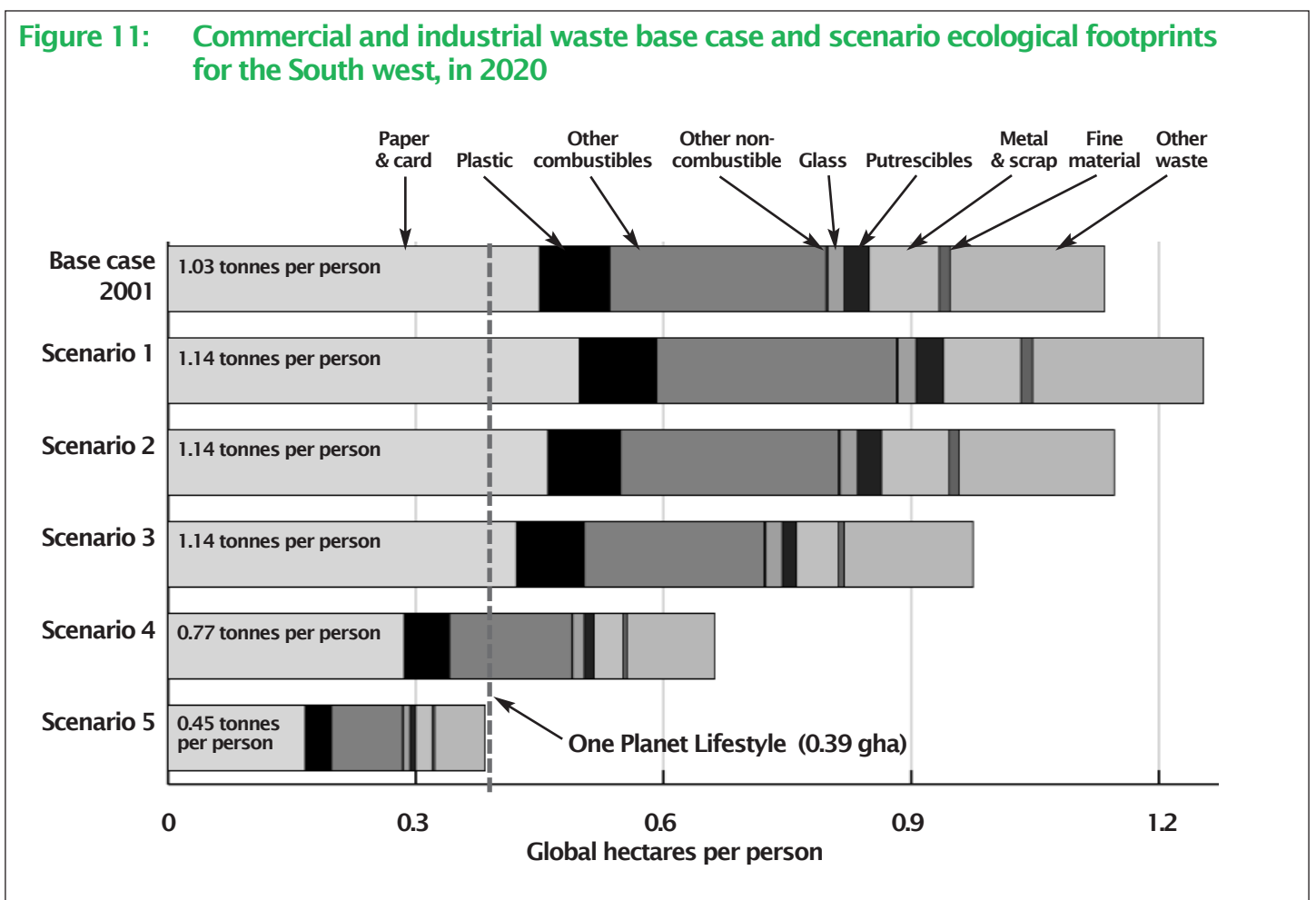
3: waste management is based on option 5, SWRA's best score for sustainability. In 2020, 17% of C&I waste is sent to landfill (see policy 7.6 in SWRA, 2003b), 56% is recycled or composted, 15% is used to produce energy and 11% is re-used (SWRA, 2003b).

4: again based on SWRA option 5, with increased waste recovery, waste to energy and waste minimisation. In 2020, 17% of C&I waste is sent to landfill (see policy 7.6 in SWRA, 2003b), 56% is recycled or composted, 15% is used to produce energy and 11% is re-used (SWRA, 2003b).

5: achieving a one planet lifestyle level of C&I waste management through much reduced waste arisings and increased levels of recovery and waste to energy. Waste arisings are 447 kg per person. In 2020, 17% of C&I waste is sent to landfill (see policy 7.6 in SWRA, 2003b), 56% is recycled or composted, 15% is used to produce energy and 11% is re-used (SWRA, 2003b).

More detail about the waste scenarios can be found in the *Scenarios Report* in print or at [www.steppingforward.org.uk](http://www.steppingforward.org.uk).

**Figure 11: Commercial and industrial waste base case and scenario ecological footprints for the South west, in 2020**



# Food

It was estimated that the South West produced almost 7 million tonnes of food in 2001. An additional 2.4 million tonnes were imported from abroad, while exports were a little over 1 million tonnes.

South West residents consumed around 3.5 million tonnes of food in 2001, approximately 698 kg of food per person over the year. Including materials used and lost during agriculture and processing, the average resident would indirectly consume 930 kg of food per year. 'Bread and cereals' and 'milk and cream' constituted almost 30% of a South West resident's diet. 87% of food consumed in the South West is eaten at home, and 13% eaten out.

Table 5 summarises food consumed in the South West in 2001, by food type and whether it was eaten at home or eaten out (for example, at restaurants).

## Food production and processing

More than 8,000 tonnes of apples were harvested in the South West in 2001. An estimated 740 tonnes of solid waste arose from the growing and harvest of these apples (90 kg/tonne). In comparison, the production of 400,000 tonnes of potatoes gave rise to an estimated 16,000 tonnes of solid waste (40 kg/tonne).

In total, the South West food processing industry generated 609,000 tonnes of waste. Just over 30% of this was reused, with recycling and waste sent to landfill being the next most common forms of waste management. The beverage industry generated the largest quantity of waste in the sector, 140,000 tonnes.

Sources: C-Tech, 2004; DEFRA, 2003a; FAO, 2002 and University of Plymouth, 2003.

## Food ecological footprint

The ecological footprint for food consumed by the South West residents in 2001, was 1.63 gha per person.

This includes food consumed by South West residents, whether in the home or eaten out, in 2001. Post-consumer food waste was not included (to avoid double counting). It accounted for 29% of a South West resident's total ecological footprint.

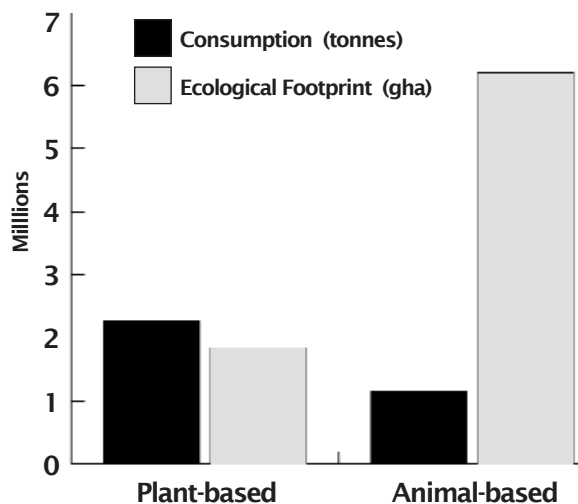
Meat and other animal-based products such as milk and cream, were responsible for 77% of the footprint (see Figure 12). Meat was the biggest contributor at 35% of the total food ecological footprint, and fish the second biggest at 31%. Plant-based food contributed 23% of the total food ecological footprint although it was 66% by weight; animal-based food takes many more resources per kilo to produce than plant-based food.

**Table 5: Food consumed by South West residents, in 2001**

Food type	Consumption ('000s of tonnes)		% of total food
	Eaten at home	Eaten out	
<b>Total food consumption</b>	<b>3,445</b>		
<b>Sub-total</b>	<b>3,012</b>	<b>432</b>	
<i>of which...</i>			
Milk & cream	577	<5	17%
Cheese	154	<5	16%
Meat	32	26	11%
Fish	256	5	11%
Eggs	42	<5	8%
Fats	43	<5	7%
Sugar & preserves	49	<5	7%
Potatoes	38	26	6%
Other vegetables*	173	18	5%
Fruit	372	5	2%
Bread & other cereals**	369	19	1%
Beverages	427	108	1%
Soft drinks	17	72	2%
Confectionery	242	<5	4%
Alcoholic drinks	33	92	2%
Other***	187	54	3%

\* Other vegetables include all fresh, green and processed vegetables such as lettuce, sprouts or carrots, but excludes potatoes.  
 \*\* Other cereals include breakfast cereals, snacks (for example popadums), cakes and flour.  
 \*\*\* Other foods include for example soups, salad dressings and sauces.  
 Note: Totals may differ due to rounding.  
 Source: DEFRA, 2002 & 2003b and ONS, 2003.

**Figure 12: Food ecological footprints of South West residents, compared with tonnages consumed, in 2001**



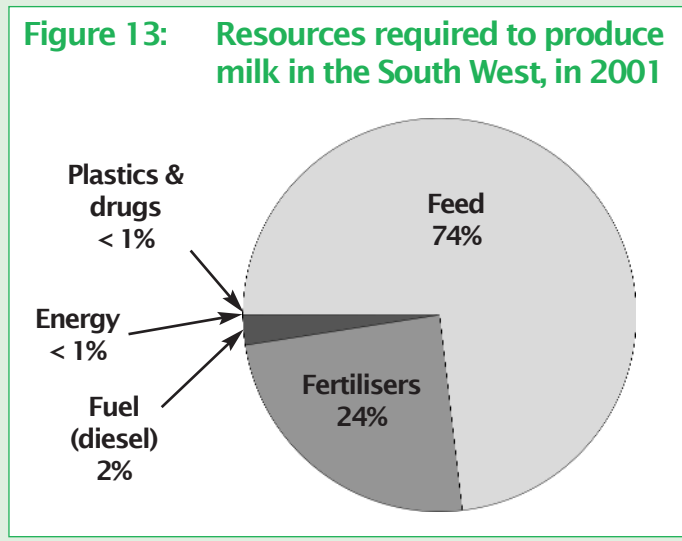
## Cream of the crop

Almost a fifth of all farms in the region are used for dairy (about 201,300 ha). This is the largest proportion in the UK. Most dairy farms are situated in Devon and Cornwall, the former having the largest number of dairy cattle in the UK. In total, the South West has 543,000 head of dairy cattle. This is just under a quarter of the UK's dairy herd.

In 2001, the herd produced over 2 million litres of milk, with the average cow producing 6,530 litres. Various inputs are required to produce this milk. Figure 13 illustrates the volume of resources (excluding water) required to process milk in the South West, during 2001 (C-Tech, 2002).

Total resource use for the dairy industry, excluding water, amounted to 826,000 tonnes. This equates to 0.42 kg of resources used per litre of milk produced. In 2001, this resource use created £261,000 GVA, or over 20% of the total GVA for the South West agricultural industry (C-Tech, 2002).

**Figure 13: Resources required to produce milk in the South West, in 2001**



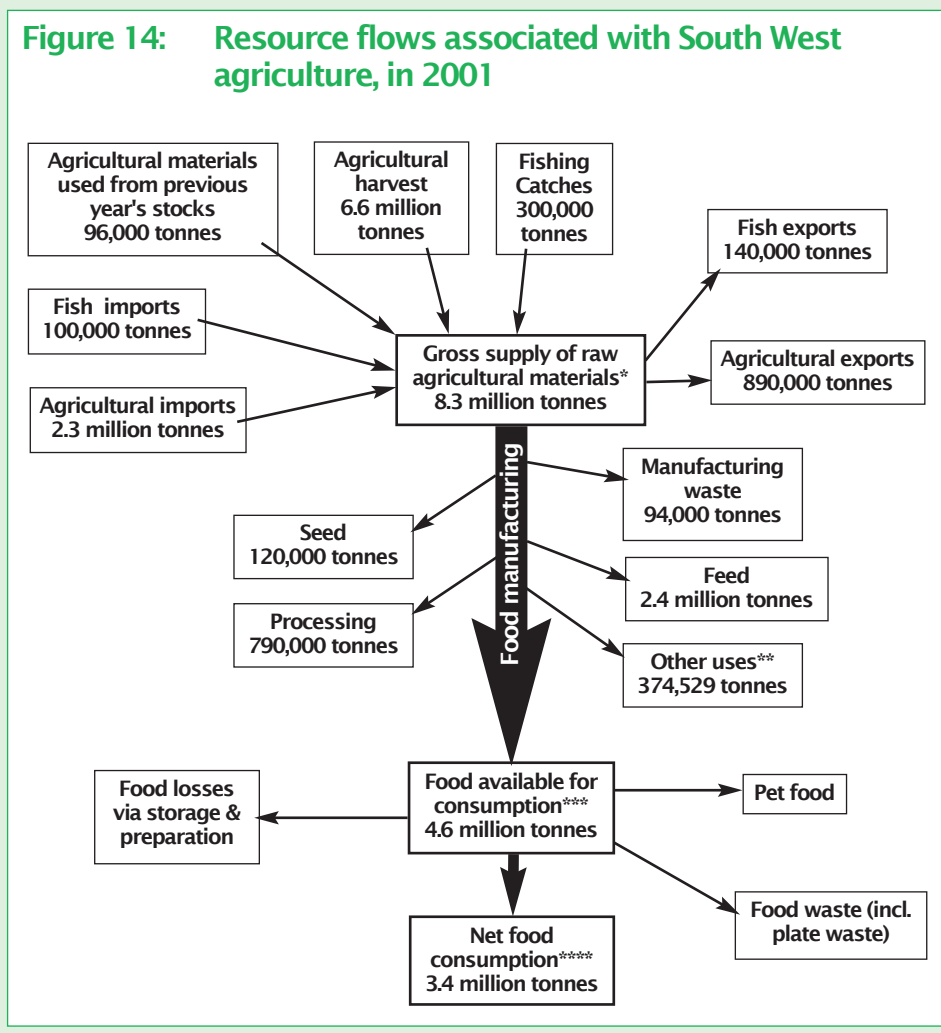
### What about outputs?

Dairy cows in the South West are responsible for over 11 million tonnes of waste every year, of which over 80% is slurry, 14% farmyard manure and 2% silage effluent. Other wastes include waste milk, plastics, paper and machinery. Most waste milk is caused by antibiotics being found in the milk, which is therefore not fit for human consumption (Environment Agency, 2000a).

## Agricultural resource flows

Agriculture in the South West is a resource intensive industry, in particular livestock farming, which required 2.4 million tonnes of feed to produce an estimated 1.5 million tonnes of meat and meat products for consumption. Figure 14 illustrates the estimated resource flows associated with agriculture in the South West.

**Figure 14: Resource flows associated with South West agriculture, in 2001**



Nearly a quarter of all agricultural waste in England and Wales is generated in the region, most of which is farmyard manure and slurry (14 million tonnes). From 2004, new agricultural waste management regulations mean that waste disposal or recovery on farms is no longer possible without a waste management licence or exemption. Farmers are required to send their waste to licensed sites, register a licensing exemption should they want to recycle waste on a farm, or apply for a license to continue disposing of waste on a farm.

Resource use and waste generation are therefore notable issues in the agricultural industry.

Resource use and waste generation are therefore notable issues in the agricultural industry.

\* Gross supply covers all raw food materials supplied to the South West before they are used in agriculture or processed.

\*\* Other uses include food for tourists, storage and non-food uses such as oil for soap.

\*\*\* Gross consumption is the amount of food available for consumption.

\*\*\*\* Net food consumption is the estimated amount of food consumed excluding pet food, losses of edible food, e.g. during storage, in preparation, as plate-waste, quantities fed to domestic animals and pets, or thrown away.

Sources: C-Tech, 2002; Dairy Council, 2004; Environment Agency, 2000 & 2004a; FAO, 2002; GOSW, 2003; NFU, 2004; Objective One, 2004; South West Observatory, 2002; University of Plymouth, 2003 and Virdee & Causer, 2003.

# Water

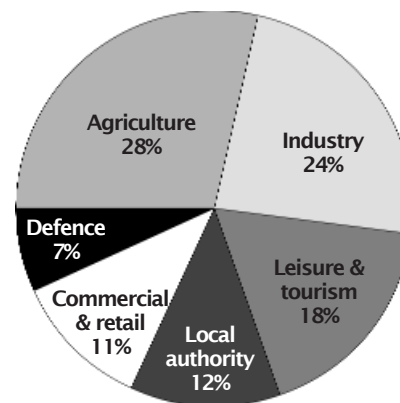
In 2001, the South West consumed an estimated **2,975,939 megalitres (MI)** of water. Households consumed 60% of public supplies. Of the remaining public water supply, the agricultural sector consumed 28%, with industry consuming 24% and leisure and tourism 18%. It was also estimated that 20% of water supplied is lost through leakage.

For more detail on water consumption, see the *Resource Flow Report* at [www.steppingforward.org.uk](http://www.steppingforward.org.uk).

Figure 15 illustrates a breakdown of water consumed by non-household users in the South West in 2001.

Over 2.6 million megalitres of water was consumed from private sources, such as dams, 97% sourced from surface water. Electricity production (61%) and fish farming (37%) used almost all the private water. (See Table 6.)

**Figure 15: Breakdown of water consumed by non-household users in the South West, in 2001**



Sources: Barton, 2004; Berry, 2004; Bristol Water, 2002; DWI, 2002; Green, 2004; Jones, 2004; Marsh, 2004; OFWAT, 2001; Pennon Group, 2002; South West Water, 2004; Turner, 2004; Water UK, 2003; Wessex Water, 2004, 2004a & 2004b and Wickens, 2004.

**Table 6: Private water abstraction in the South West, by sector, in 2001**

	Megalitres per day	Megalitres per year
<b>Total private water</b>	<b>7,191</b>	<b>2,624,715</b>
<b>Household supply</b>	<b>31</b>	<b>11,315</b>
of which...		
Surface	23	8,395
Ground	8	2,920
<b>Industry</b>	<b>73</b>	<b>26,645</b>
of which...		
Surface	48	17,520
Ground	25	9,125
<b>Spray irrigation</b>	<b>4</b>	<b>1,460</b>
of which...		
Surface	2	730
Ground	2	730
<b>Agriculture</b>	<b>45</b>	<b>16,425</b>
of which...		
Surface	6	2,190
Ground	39	14,235
<b>Fish farming</b>	<b>2,637</b>	<b>962,505</b>
of which...		
Surface	2,509	915,785
Ground	128	46,720
<b>Electricity</b>	<b>4,362</b>	<b>1,592,130</b>
of which...		
Surface	4,360	1,591,400
Ground	2	730
<b>Other *</b>	<b>39</b>	<b>14,235</b>
of which...		
Surface	5	1,825
Ground	34	12,410

\* Other includes unaccounted and illegal water abstractions.  
Source: Water UK, 2003.

## Water ecological footprint

The water ecological footprint for a resident in the South West, in 2001, was 0.01 gha, and accounted for less than 1% of the total ecological footprint.

The water ecological footprint takes into account the energy required to collect, treat and supply the water used by residents in the South West. 45% of the footprint is associated with wastewater treatment, and 55% with the energy used to supply the water.

For more detail on the water footprint, see the *Ecological Footprint Report* at [www.steppingforward.org.uk](http://www.steppingforward.org.uk).

## Land use

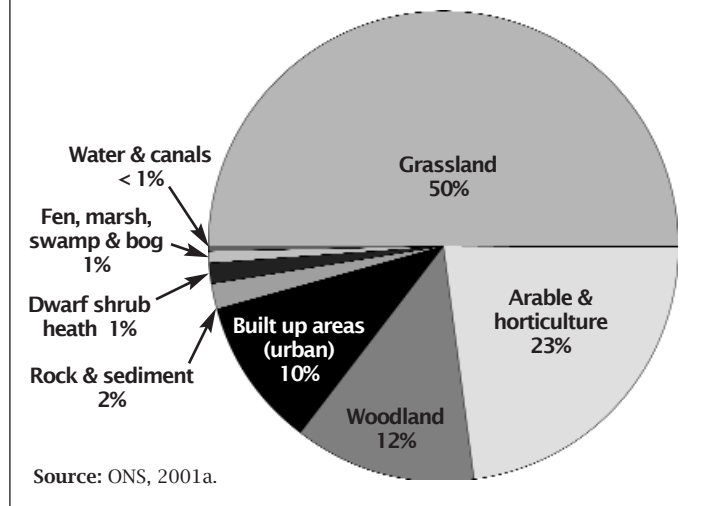
The South West covers a total physical land area of 2.3 million hectares (ha) of which half is grassland. Arable and horticulture take 23% of the total land area, while 10% is urban or built up areas. Figure 16, overleaf, summarises land cover in the South West, in 2001.

The built land ecological footprint for the South West in 2001 was 0.26 gha per person, and accounted for 5% of a South West resident's total ecological footprint.

The built land component includes all areas that have been built on, for example houses, roads or industrial sites. Land used for commercial and industrial activities had the largest impact, at 46% of the built land ecological footprint.

For more detail on land use, see the *Resource Flow Report* and *Ecological Footprint Report* at [www.steppingforward.org.uk](http://www.steppingforward.org.uk).

**Figure 16: Land cover in the South West, in 2001**



In comparison with national travel trends, South West residents travel less by bus (253 pass-km per person) and rail (413 pass-km per person) than the average English passenger, who travels 377 and 723 pass-km respectively. This is likely to be a reflection of geographic nature of the South West, where towns and villages are more isolated and public transport is limited. Trips for leisure and commuting to work are the two main reasons for travelling, representing 39% and 29% respectively of all personal transport in the South West. 70% of commuter trips to work were done by car, followed by rail at 12%. (See Figure 17.)

For more detail on personal transport, see the *Resource Flow Report* at [www.stepsforward.org.uk](http://www.stepsforward.org.uk).

## Personal transport ecological footprint

## Transport

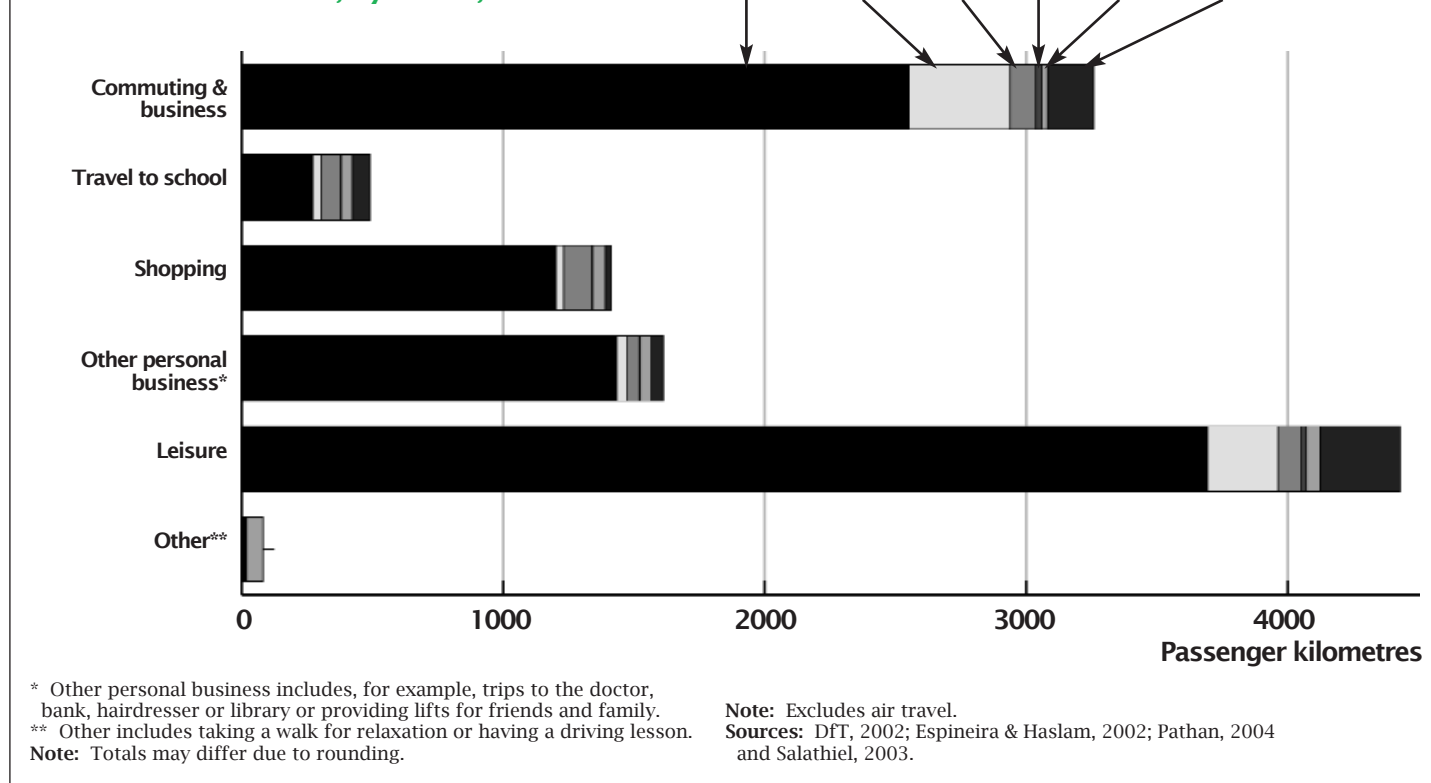
This component covers all modes of transport used by residents of the South West in 2001. Freight and commercial transport are not included.

Residents in the South West travelled an estimated **56.3 billion passenger kilometres (pass-km) in 2001, an average of 11,416 pass-km per year.** The most common mode of transport used was the private car, 82% of total travel (51% as drivers and 31% as passengers).

The personal transport ecological footprint for residents in the South West in 2001 was 0.53 gha per person, and accounted for 10% of the total ecological footprint of the region.

The largest component was car travel, which accounted for 79% of the personal transport ecological footprint. Air travel had the second largest ecological footprint at 15%, although it was only 5% of the distance travelled. The air travel ecological footprint is high due to the energy input required for flying, particularly at take-off and landing.

**Figure 17: Purpose of travel for a South West resident, by mode, in 2001**



The personal transport ecological footprint includes all personal travel by South West residents in 2001. The footprint takes into consideration the energy required for manufacturing, maintenance and fuel used for different modes of transport. It does not include freight transport, which is accounted for in the 'materials and waste' ecological footprint as part of a product's impact.

For more detail on the personal transport footprint, see the *Ecological Footprint Report* at [www.steppingforward.org.uk](http://www.steppingforward.org.uk).

Figure 18 shows a breakdown of the personal transport ecological footprint, by mode.

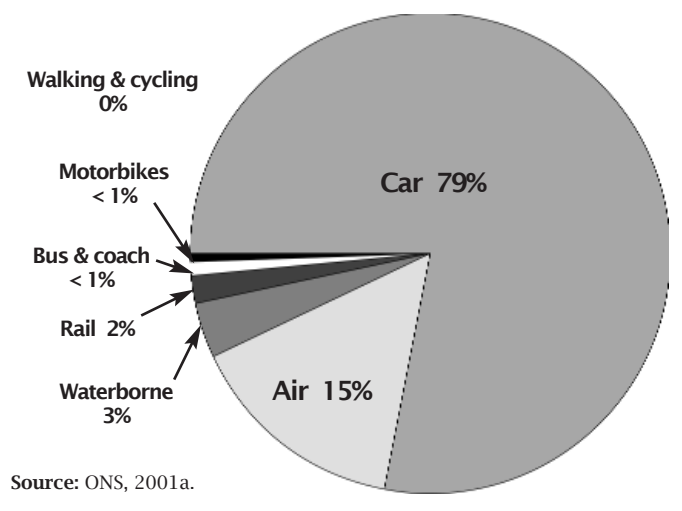
## Transport scenarios

Transport scenarios investigated personal transport only. Personal transport accounted for 10% of the South West's total ecological footprint in 2001. The scenarios investigate changes in the way people travel, as well as increases in efficiency of travel, and are built on the 2001 base case with a footprint of 0.53 gha per person.

For more detail on personal transport scenarios, see the *Scenarios Report* in print or at [www.steppingforward.org.uk](http://www.steppingforward.org.uk).

Figure 19 shows the ecological footprints for the personal transport base case and several scenarios.

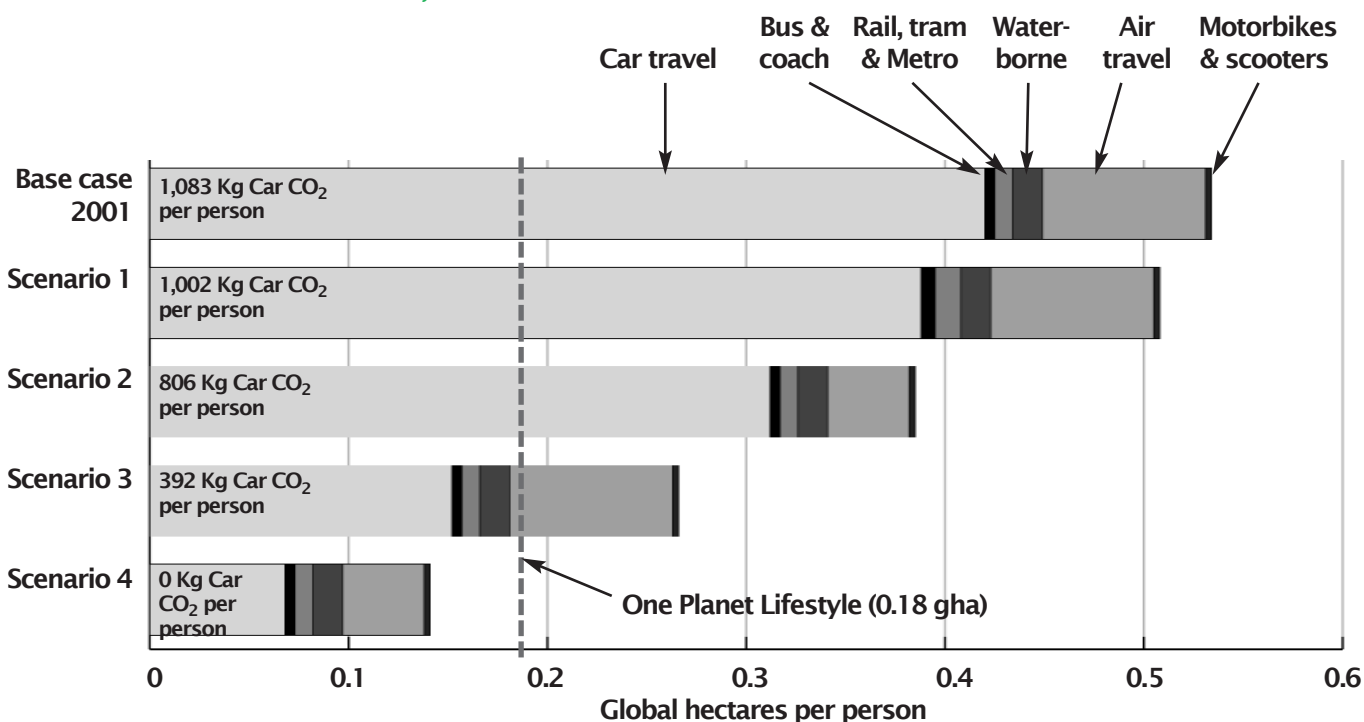
**Figure 18: Personal transport ecological footprint for a South West resident, by mode, in 2001**



### Transport Scenarios:

- 1: meets local targets for reducing car commuter travel and increases other modes of transport.
- 2: overall distance travelled is reduced for car and air travel, without increasing other travel modes.
- 3: fuel efficiency of the South West's car fleet is improved from current average fuel consumption to the best currently available.
- 4: includes further measures required to achieve a one planet lifestyle level for environmentally sustainable transport use in the South West.

**Figure 19: Personal transport base case and scenario ecological footprints for the South West, in 2001**



Note: Walking and cycling are not included as they have a low ecological footprint.

## Biofuels

In 2001, 28,600 million kilometres were travelled by cars in the South West, with a further 398 million kilometres travelled by motorbike (Espineira & Haslam, 2002; Pathan, 2004 and Salathiel, 2003). Transport energy use is projected to grow by 2% per year, with a corresponding increase in greenhouse gas emissions (DTI, 2000). To limit greenhouse gas emissions from this sector, the European Commission (2003) has set a minimum target for each member state to replace 5.75% of all petrol and diesel consumed (by energy content) with biofuel (or other renewable fuels) by 2010. Further information on biofuels can be found in 'Additional Information' at [www.steppingforward.org.uk](http://www.steppingforward.org.uk).

### Scenario 1: Optimum mix to meet European target of 5.75% biofuels

How would the biofuels ecological footprint change with a change in the biodiesel/bioethanol mix?

#### The following variables were assumed:

- A 2% annual increase in passenger kilometres travelled by car and motorbike from 2001 to 2015.
- All motorcycles run on petrol, and 52% of cars in 2010 will use petrol, compared to 57% in 2001 (DTI, 2000).
- Fuel consumption values for cars and motorcycles were taken from *Energy Consumption in the UK* (DTI, 2000).
- The average car is four years old.
- All the biofuels needed will be produced in the South West.
- Coefficients for land requirements and plant costs come from the SAFIRE model (ESD, 2004).

The area of land required to provide this amount of biofuels depends upon the fuel replacement mix. If only biodiesel was used to meet the target, this would require 128,000 hectares of land (24% of the South West's available land) for growing biofuel energy crops. However, if only bioethanol was used to meet the target, this would require 30,000 hectares of land (6% of the South West's available land) for growing biofuel energy crops.

Table 7 illustrates the change in the ecological footprint as the proportion of bioethanol increases in the biofuel mix. Bioethanol has a lower ecological footprint than biodiesel. The mix selected will have implications in terms of cost, for plants to process the fuel, and land required; bioethanol gives a greater yield in terms of litres of fuel per hectare per year.

### Scenario 2: One planet lifestyle mix

How large would the biofuels ecological footprint be if 100% of car, taxi and motorbike travel was fuelled by bioethanol?

#### Units

**kg CO<sub>2</sub> eq:** Kilogrammes of carbon dioxide equivalent.

**GJ:** Gigajoules, i.e. 1,000,000,000 joules.

**odt:** Oven dried tonne.

**ha:** hectare.

#### The following variables were assumed:

- Passenger kilometres travelled by car, taxi and motorbike from 2001 to 2015 remain at 2001 levels.
- All motorcycles and cars run on 100% biofuels.
- All the biofuels needed to run cars, taxis and motorcycles will be produced in the South West.
- Coefficients for energy requirements were taken from Hart *et al.* (2003) and assume bioethanol produced from short rotation coppice. Carbon emissions account for fossil fuel inputs to biomass production and transport and range from 4 to 90 kg CO<sub>2</sub> eq/GJ. An average of 47 kg CO<sub>2</sub> eq/GJ was used.
- Coefficients for land requirements were taken from Hart *et al.* (2003) and assume a yield of 15 odt/ha/yr and an energy content of 18 GJ/odt.

It would take almost 292,000 hectares (an ecological footprint of 0.31 gha per person) to produce enough bioethanol to fuel all South West cars, taxis and motorbikes travelling an annual amount equivalent to 2001. This is more than 54% of the arable land in the South West. Hart *et al.* (2003) state that the UK land availability for short rotation coppice by 2050 will be 25% of 'agricultural' land. It is also worth considering that the present supply of bioethanol for transport use in the UK is zero (Hart *et al.*, 2003).

**Table 7: Ecological footprints of different bioethanol and biodiesel mixes for the South West, in 2015**

Proportion of bioethanol (%)	Total biofuel (million litres)	Plant costs to produce in the South West (£m)	Land required ('000 hectares)	Ecological footprint per person (gha)
0	152	13	130	0.14
20	153	16	110	0.12
40	154	18	90	0.10
60	155	21	70	0.07
80	156	24	50	0.05
100	157	26	30	0.03

# Tourism

Tourism contributes 10% to the South West's economy, and accounts for 10% of employment - about 78,000 jobs. Visitors to the region are predominantly domestic holidaymakers, making 24.4 million trips in 2001. This is 19% of all England's domestic tourist trips and brings in an income of £3,900 million. Overseas visitors made a total of 1.9 million trips and spent an estimated £635 million. A little under £2,500 million was spent by tourists on food and drink, of which an estimated 49% was produced locally (SWRRG, 2003).

The most frequent form of accommodation for domestic tourists was staying with friends or relatives (31% of bednights). The next most favoured places to stay were serviced accommodation, holiday centres and self-catering. As would probably be expected, most overseas tourists stayed in serviced accommodation, but staying with friends and relatives was also common.

The South West tourism industry is ready to expand. Current expectations suggest an 80% increase in trips from 1999 figures by 2020 (LSGSW, 2000). Scenarios presented here examine the potential impacts of tourist-related energy use, waste, travel and water consumption.

For more detail on the tourism scenarios summarised here, see the *Tourism Report* at [www.steppingforward.org.uk](http://www.steppingforward.org.uk).

## Tourism energy scenarios

**Base case:** the ecological footprint for 4,510 GWh energy use associated with tourism in 2001 is 360,000 gha.

**Scenario 1:** applying good housekeeping, with retrofit and refurbishment options, throughout all tourist accommodations in the South West reduces energy consumption and the energy footprint by 40%.

**Scenario 2:** the tourist season is extended into winter and tourist numbers increase by 80%. Energy management remains as now, and energy consumption and the energy footprint increase by 115%.

**Scenario 3:** the tourist season is extended into winter, and tourist numbers increase by 80%, while implementing energy saving measures as in scenario 1. Energy consumption and the energy footprint increase by 50%.

## Tourism waste scenarios

**Base case:** the ecological footprint for 119,980 tonnes of waste associated with tourism in 2001 is 132,000 gha.

**Scenario 1:** increasing recycling to 60% reduces the waste footprint by 16%.

**Scenario 2:** increasing recycling to 60% and reducing waste by 25% reduces the waste footprint by 27%.

## Tourism transport scenario

In 2001 it is estimated that domestic tourists travelled 4,000 million kilometres (kms) to and from the South West, 91% by car. Overseas tourists travelled 5,800 million kms, 76% by air.

A scenario assumes total distance travelled remains constant, with a 20% reduction in car use in the first 5 years, and another 20% in the following 10 to 15 years (DfT, 2003). It allows for overseas tourists to continue to use air and ferry transport. The ecological footprint is reduced by < 4% - transport modal shift and reductions in car travel have little impact on the transport ecological footprint because of the dominance of air travel.

## Tourism water scenario

On average, tourists in the South West in 2001 consumed 394 litres of water each per bednight, giving an ecological footprint of 4,700 gha.

Water reduction measures, such as repairing leaks and installing water saving devices, throughout all tourist accommodations in the South West, could reduce the water footprint by 34%.

## The Glastonbury Festival

The Glastonbury Festival is the largest greenfield music and performing arts festival in the world. Every June, for three days, a crowd of 150,000 pack a 900 acre site near Pilton village in Somerset.

Effective waste management practices have become a part of the event, and in 2004, for the first time, 110 tonnes of organic waste was converted to compost and used on the local farm. Recycling has also been a key initiative, with the Festival's recycling centre increasing its collection of waste for recycling from 38 tonnes in 2002 to 410 tonnes in 2004. Plans are in place to reach a recycling target of 24% of all litter.

The Festival also promotes and uses sustainable disposable products, such as wood based cutlery which was turned into wood chip, and biodegradable rubbish bags, plates and drinks containers.

For further information on these initiatives, visit [www.glastonburyfestivals.co.uk](http://www.glastonburyfestivals.co.uk).

**Sources:** *Edie News*, 2004 and Glastonbury Festival, 2004.

# References

- AEAT. 2003. *Personal Communication*. AEA Technology, Abingdon.
- AEAT. 2001. *Regional Renewable Energy Statistics*. AEA Technology, Abingdon.
- Barton, R. 2004. *Personal Communication*. Bournemouth & West Hampshire Water, Bournemouth.
- bdaZEDfactory. 2004. *M&E/Lifestyle/Transport Strategy*. Bill Dunster Architects ZEDfactory Ltd, Wallington.
- Berry, M. 2004. *Personal Communication*. Bristol Water Plc., Bristol.
- BGS. 2002. *United Kingdom Minerals Yearbook 2001*. British Geological Survey, Keyworth.
- Bringezu, S. & Shutz, H. 2001. *Total Material Resource Flows of the United Kingdom*. Department of Environment, Food and Rural Affairs, London.
- Bringezu, S. & Shutz, H. 2001a. *Total Material Resource Flows of the United Kingdom: Technical Annex*. Department of Environment, Food and Rural Affairs, London.
- Bristol Water. 2002. *Water Quality in 2001*. Bristol Water Plc., Bristol.
- Causser, P. & Williams, T. (Eds). 2002. *Region in Figures: South West Winter, No. 6*. Office for National Statistics, London.
- CHAIN. 2004. *Quarrying: A Brief History of Cornish China-Clay*. Cornwall Heritage Access Information Network, [www.chain.org.uk/chain-theme/ind\\_qual.html](http://www.chain.org.uk/chain-theme/ind_qual.html). Accessed May 25, 2004.
- Chambers, N., Simmons, C. & Wackernagel, M. 2000. *Sharing Nature's Interest: Ecological footprints as an Indicator of Sustainability*. Earthscan, London.
- China Clay Museum. 2004. *The China Clay Museum: Wheal Martyn, St Austell*. [www.chycor.co.uk/tourism/cata-guest/wheal-martyn/wheal-martyn.htm](http://www.chycor.co.uk/tourism/cata-guest/wheal-martyn/wheal-martyn.htm). Accessed May 20, 2004.
- Cornwall UK. 2004. *The China Clay Industry*. [www.cornwalluk.net/clay/page1.htm](http://www.cornwalluk.net/clay/page1.htm). Accessed May 20, 2004.
- C-Tech. 2004. *United Kingdom Food and Drink Processing Mass Balance*. C-Tech Innovation, Chester.
- C-Tech. 2002. *Agricultural Waste Mass Balance: Opportunities for Recycling and Producing Energy from Waste Technologies*. C-Tech Innovation, Chester.
- Dairy Council. 2004. *The Facts: On Farming*. [www.milk.co.uk](http://www.milk.co.uk). Accessed June 1, 2004.
- Dartmoor National Park. 1998. *Land Use Issues*. Dartmoor Fact Sheet. Dartmoor National Park Authority, Yelverton.
- DEFRA. 2003. *Expenditure and Food Survey*. Office for National Statistics, London.
- DEFRA. 2003a. *Family Food in 2001/2002*. Office for National Statistics.
- DEFRA. 2003b. *Guidelines for the Measurement and Reporting of Emissions by Direct Participants in the UK ETS*. Department for Environment, Food and Rural Affairs, London.
- DEFRA. 2003c. *June 2001 Agricultural Census: Agricultural Holdings by England and Region, County/Unitary Authority*. Department for Environment, Food and Rural Affairs, [www.defra.gov.uk/esg/work\\_html/publications/cs/farmstats\\_web/default.htm](http://www.defra.gov.uk/esg/work_html/publications/cs/farmstats_web/default.htm). Accessed April 2004.
- DEFRA. 2002. *Basic Horticultural Statistics 2002*. Department for Environment, Food and Rural Affairs, London.
- DEFRA. 2002a. *South West: Other Primary Industries*. Department for Environment, Food and Rural Affairs, [www.defra.gov.uk/erdp/docs/swchapter/section14/otherprimaryindustries.htm](http://www.defra.gov.uk/erdp/docs/swchapter/section14/otherprimaryindustries.htm). Accessed May 25, 2004.
- DEFRA. 2000. *National Food Survey 2000*. Office for National Statistics, London.
- DEFRA. 2000a. *Waste Strategy 2000 for England and Wales*. Department for Environment, Food & Rural Affairs, London.
- DETR. 1996. *English House Condition Survey: Energy Report*. Department of Environment, Transport and Regions, London.
- DfT. 2002. *National Travel Survey: 2002*. Department for Transport, London.
- DfT. 2003. *The Good Practice guide for the development of local transport plans*. Department for Transport, London
- DTI. 2004. *Oil and Gas*. Department of Trade and Industry, [www.og.dti.gov.uk/information/bb\\_updates/appendices/Appendix9.htm](http://www.og.dti.gov.uk/information/bb_updates/appendices/Appendix9.htm). Accessed April 2004.
- DTI. 2004a. *Personal Communication*. Department of Trade and Industry, London.
- DTI. 2004b. *Personal Communication*. Department of Trade and Industry, London.
- DTI. 2003. *Energy Consumption in the UK: Tables*. Department of Trade and Industry, [www.dti.gov.uk/energy/inform/energy\\_consumption](http://www.dti.gov.uk/energy/inform/energy_consumption). Accessed September 2003.
- DTI. 2003a. *Energy Trends*. Department of Trade and Industry, London.
- DTI. 2003b. *Energy White Paper: Our Energy Future: Creating a Low Carbon Economy*. Department of Trade and Industry, London.
- DTI. 2002. *Digest of UK Energy Statistics*. Department of Trade and Industry, London.
- DTI. 2000. *Energy Paper 68: Energy Projections for the UK*. Department of Trade and Industry, London.
- DWI. 2002. *Chief Inspector's Report 2002: 5 Cholderton and District Water Company Limited*. [www.dwi.gov.uk/pubs/annrep02/Cholderton.htm](http://www.dwi.gov.uk/pubs/annrep02/Cholderton.htm). Accessed March 2004.
- Edie News. 2004. *Glastonbury Festival Introduces Composting to Green Credentials*. [www.edie.net/news/news\\_story.asp?id=8373&channel=0](http://www.edie.net/news/news_story.asp?id=8373&channel=0). Accessed May 2004.
- ENDS. 2004. *Imerys: Managing the China Clay Industry's Environmental Impacts*. ENDS Report 353, June, p21-24.
- Environment Agency. 2004a. *South West Region: Agriculture*. [www.environment-agency.gov.uk/regions/southwest/315944/316002/?version=1&lang=\\_e&textonly=on&format=](http://www.environment-agency.gov.uk/regions/southwest/315944/316002/?version=1&lang=_e&textonly=on&format=). Accessed May 25, 2004.
- Environment Agency. 2000. *Agriculture and the Environment: An Impact Statement*. Consultation draft. Environment Agency, Bristol.
- Environment Agency. 2000a. *Strategic Waste Management Assessment 2000: South West*. Environment Agency, Reading.
- Environment Agency & RTAB. 2004. *South West Waste Audit 2000/01*. Environment Agency and Regional Technical Advisory Body, Bridgewater.
- Espineira, J. & Haslam, M. 2002. *Regional Transport Statistics: 2002*. Department for Transport, London.
- European Commission. 2003. *Directive 2003/30/EC: Promotion of the Use of Biofuels or Other Renewable Fuels for Transport (Article 1(b)(ii))*. European Commission, Belgium.
- FAO. 2002. *United Kingdom Food Balance Sheet 2001*. Food and Agriculture Organisation, <http://apps.fao.org/faostat/form?collection=FBS&Domain=FBS&servlet=1&hasbulk=0&version=ext&language=EN>. Accessed April 2004.

- Forestry Statistics. 2003. *A Compendium of Statistics About Woodland, Forestry and Primary Wood Processing in the United Kingdom*. Office of National Statistics, London.
- Glastonbury Festival. 2004. *Glastonbury Festival 2004*. [www.glastonburyfestivals.co.uk](http://www.glastonburyfestivals.co.uk). Accessed May 2004.
- GOSW. 2003. *Sustainable Farming and Food Strategy: An Action Plan for the South West*. Government Office for the South West, Bristol.
- GOSW & DTLR. 2003. *Regional Planning Guidance for the South West (RPG10)*. Government Office for the South West and Department of Transport and the Local Regions, London.
- GOSW & SWRA. 2004. *REvision 2010: Establishing County Sub-Regional Targets for Renewable Electricity Development to 2010*. Government Office for the South West and South West Regional Assembly, Bristol.
- Green, G. 2004. *Personal Communication*. Wessex Water, Bath.
- Griffiths, P. & Lewis, K. 2004. *Development of a Standardised Methodology for Resource Flow Analysis and its Application to Sub-National Regions*. Paper delivered at the Clean Air Congress, London.
- Hart, D.; Bauen, A.; Chase, A. & Howes, J. 2003. *Liquid Biofuels and Hydrogen from Renewable Resources in the UK to 2050: A Technical Analysis*. E4tech (UK), London.
- Highley, D.; Mankelov, J.; Sen, M.; Coats, J.; White, R.; Hobbs, S. & Bartlett, E. 2003. *Collation of the Results of the 2001 Aggregate Minerals Survey for England and Wales*. British Geological Survey, Nottingham.
- HM Customs & Excise. 2002. *Aggregates Levy*. HM Customs & Excise, Carmarthen.
- Honda. 2001. *Safety & Environment Report*. Honda UK Manufacturing Ltd. Swindon, Wiltshire.
- Jones, G. 2004. *Personal Communication*. Wessex Water, Bath.
- Linstead, C.; Ekins, P. & Gervais, C. 2003. *Mass Balance: An Essential Tool for Understanding Resource Flows*. Forum for the Future, London.
- Loh, J. (Ed.) 2002. *Living Planet Report 2002*. World Wide Fund for Nature, Switzerland.
- LSGSW. 2000. *A Guide to Sustainable Tourism in the South West*. Our South West, [www.oursouthwest.com/RegiSus/tourism.html](http://www.oursouthwest.com/RegiSus/tourism.html). Accessed May 24, 2004
- Marsh, A. 2004. *Personal Communication*. WaterVoice, Birmingham.
- Mitchell, T. & Regen, A. 1998. *A Spreadsheet-based Model to Estimate Local Energy Demand and Greenhouse Gas Emissions*. Centre for Energy and the Environment, Exeter University.
- NFU. 2004. *Farming in the South West*. National Farmers Union, [www.nfu.org.uk/stellentdev/groups/public/documents/regional\\_article/farminginthesouthwe\\_ia3f7070fc.hcsp](http://www.nfu.org.uk/stellentdev/groups/public/documents/regional_article/farminginthesouthwe_ia3f7070fc.hcsp). Accessed May 14, 2004.
- Objective One. 2004. *Harvesting Cornwall*. The Objective One Partnership for Cornwall and Scilly, [www.objectiveone.com/client/Showcase/mix2.htm](http://www.objectiveone.com/client/Showcase/mix2.htm). Accessed June 2, 2004.
- ODPM. 2004. *Minerals Planning Guidance 1: General Considerations*. Office of the Deputy Prime Minister, [www.odpm.gov.uk/stellent/groups/odpm\\_planning/documents/page/odpm\\_plan\\_606843-05.hcsp](http://www.odpm.gov.uk/stellent/groups/odpm_planning/documents/page/odpm_plan_606843-05.hcsp). Accessed May 25, 2004.
- ODPM. 2001. *English House Condition Survey*. Office of the Deputy Prime Minister, London.
- OFWAT. 2001. *Leakage and the Efficient Use of Water 2000/01*. Office of Water Services, Birmingham.
- ONS. 2004a. *International Passenger Survey*. Office for National Statistics, London.
- ONS. 2003. *Mid-2001 Population Estimates*. Office for National Statistics, [www.statistics.gov.uk/statbase/Expodata/Spreadsheets/D7110.xls](http://www.statistics.gov.uk/statbase/Expodata/Spreadsheets/D7110.xls). Accessed February 2004.
- ONS. 2003a. *Regional Gross Value Added*. Office for National Statistics, [www.statistics.gov.uk/StatBase/Product.asp?vInk=7359](http://www.statistics.gov.uk/StatBase/Product.asp?vInk=7359). Accessed September 2003.
- ONS. 2003b. *Region in Figures: South West. Winter 2003, No. 7*. Office for National Statistics, London.
- ONS. 2001. *Product Sales and Trade: PRA 12-36*. Office for National Statistics, London.
- ONS. 2001a. *Regional Trends 37*. Office for National Statistics, London.
- Pathan, N. 2004. *Personal Communication*. Department for Transport, London.
- Pennon Group. 2002. *Enhancing the Environment 2002: An Environmental and Social Report*. Pennon Group Plc., Exeter.
- Poll, J. 2003. *The Composition of Municipal Solid Waste in Wales: A Report Produced for the Welsh Assembly Government*. AEA Technology, Harwell.
- Redefining Progress. 2002. *National Footprint Accounts*. Spreadsheets purchased under licence agreement. Redefining Progress, California.
- Reid, M. 2003. *A Strategy for Construction, Demolition and Excavation Waste as Recycled Aggregates*. Waste and Resources Action Programme, Banbury.
- REWARD. 2004. *REWARD Database*. Generated as part of the Wales and Regions Economic Resource Productivity project, [www.reward-uk.org](http://www.reward-uk.org). Accessed February 2004.
- Salathiel, D. 2003. *Personal Communication*. National Travel Survey: Department for Transport, London.
- Scottish Executive. 2003. *Proposed EU Directive on the Management of Waste from the Extractive Industries*. [www.scotland.gov.uk/consultations/environment/eudw-07.asp](http://www.scotland.gov.uk/consultations/environment/eudw-07.asp). Accessed May 2004.
- SDS. 2005. *Securing the Future*. [www.sustainable-development.gov.uk](http://www.sustainable-development.gov.uk)
- South West Observatory. 2002. *Spotlights: Agriculture*. South West Observatory and Environment Agency, [www.swenvo.org.uk/environment/spot\\_agric1.asp](http://www.swenvo.org.uk/environment/spot_agric1.asp). Accessed June 2, 2004.
- South West Water. 2004. *All the Things You Ever Wanted to Know About South West Water*. [www.southwestwater.co.uk/index.cfm?articleid=234](http://www.southwestwater.co.uk/index.cfm?articleid=234). Accessed February 2004.
- SWRA. 2004. *From Rubbish to Resource: The Regional Waste Strategy for the South West 2004-2020*. South West Regional Assembly, Taunton.
- SWRA. 2003a. *Developing a Regional Waste Strategy for the South West Regional Assembly*. South West Regional Assembly, Taunton.
- SWRRG. 2003. *The Value of Tourism to the South West Economy in 2001*. South West Regional Research Group for South West Tourism, Exeter.
- Symonds Group. 2003. *Survey of Arisings and Use of Construction and Demolition Waste 2001*. Office of the Deputy Prime Minister, London.
- The Potteries. 2004. *Materials Used in the Manufacture of Ceramics: China Clay*. [www.netcentral.co.uk/steveb/types/chinaclay.htm](http://www.netcentral.co.uk/steveb/types/chinaclay.htm). Accessed May 20, 2004.
- Transco. 2003. *Gas Demand Data by Postcode Sector for 2001 and 2002*. Transco, [www.transco.co.uk](http://www.transco.co.uk). Accessed September 2003.
- Turner, T. 2004. *Personal Communication*. South West Water, Exeter.
- University of Plymouth. 2003. *The Integrated Economic Information System for the South West (ECONI)*. Plymouth Business School, University of Plymouth, Plymouth.
- Virdee, D. & Causer, P. 2003. *Region in Figures: South West. Winter, No. 7*. Office for National Statistics, London.
- Water UK. 2003. *Estimated Water Abstractions*. [www.water.org.uk/index.php?cat=2-1003](http://www.water.org.uk/index.php?cat=2-1003). Accessed April 2004.
- Wessex Water. 2004. *Our Environment*. [www.wessexwater.co.uk/strikingthebalance01/data\\_charts/data-environment.html](http://www.wessexwater.co.uk/strikingthebalance01/data_charts/data-environment.html), Accessed March 2004.
- Wessex Water. 2004a. *Water Leakage*. [www.wessexwater.co.uk/water/leakage.html](http://www.wessexwater.co.uk/water/leakage.html). Accessed March 2004.
- Wessex Water. 2004b. *Water Supply*. [www.wessexwater.co.uk/water/](http://www.wessexwater.co.uk/water/). Accessed March 2004.
- Western Power. 2004. *Personal Communication*. Western Power Distribution, Bristol.
- Wickens, P. 2004. *Personal Communication*. Wessex Water, Bath.

# Conversion tables

Length	Data	Unit
1 kilometre (km) is equal to:	0.621	Miles
	1,094	Yards
	1,000	Metres
1 metre (m) is equal to:	100	Centimetres
	39.4	Inches
1 mile is equal to:	1.609	Kilometres
	1,760	Yards
	1,609	Metres
1 passenger-km	one person travelling 1 km	
1 tonne-km	one tonne travelling 1 km	

Weight	Data	Unit
1 tonne (t) is equal to:	1000	Kilogrammes
	1 million	Grammes
	0.984	Long ton
	1.102	Short ton
Volume	Data	Unit
1 litre (l) is equal to:	0.22	Imperial gallon (UK gal)
	0.26	US gallons
Area	Data	Unit
1 hectare (ha) is equal to:	10,000	Square metres
	2.47	Acres
	107,639	Square feet

Energy	Data	Unit
1 GigaWatt hour (GWh) is equal to:	85.98	Tonnes of oil equivalents
	3,600	Gigajoules
	1 million	KiloWatt hours (KWh)
	34,120	Therms (European)
	3,412 million	British thermal units (Btu)
	8,598,452,278,590	Calories
1 tonne of oil equivalent is equal to:	10,000,000	Kilocalories
	396.8	Therms (European)
	41.87	Gigajoules
	11,630	KWh
	39,680,000	British thermal units (Btu)

## The following prefixes are commonly used:

<b>Kilo (k)</b> = 1000	<b>or 10<sup>3</sup></b>
<b>Mega (M)</b> = 1,000,000	<b>or 10<sup>6</sup></b>
<b>Giga (G)</b> = 1,000,000,000	<b>or 10<sup>9</sup></b>

Source: DTI, 2002.

# Abbreviations

£	Pound Sterling
°C	Degrees Celsius
AEAT	AEA Technology
BGS	British Geological Survey
BFF	Best Foot Forward Ltd.
C&D	Construction & Development
C&I	Commercial & Industrial
CAA	Civil Aviation Authority
CHP	Combined heat & power
CO <sub>2</sub>	Carbon dioxide
CPU	Central processing unit
CIRIA	Construction Industry Research & Information Association
CREM	Consultancy & Research for Environmental Management
DEFRA	Department of Environment, Food & Rural Affairs
DfT	Department for Transport
DTI	Department of Trade & Industry
EC	European Community
ECIP	European Common Indicators Programme
ECONI	An integrated economic information system for the South West, University of Plymouth
EEBPP	Energy Efficiency Best Practice Program (now known as Envirowise)
EfW	Energy from Waste
ESD	Energy for Sustainable Development
EST	Energy Saving Trust
EU	European Union
FTE	Full-time equivalent
g	Grammes
GDP	Gross Domestic Product
gha	Global hectares
GVA	Gross Value Added

GJ	Gigajoules
GOSW	Government Office for the South West
GWh	Gigawatt hour
ha	Hectare
HM	Her Majesty's
IEA	International Energy Agency
km	Kilometre
KWh	KiloWatt hour
l	Litre
m <sup>2</sup>	Square metre
m <sup>3</sup>	Cubic metre
M l	Megalitre
MSW	Municipal Solid Waste
MWh	MegaWatt hour
NAEI	National Air Emissions Inventory
NFU	National Farmers Union
ODPM	Office of the Deputy Prime Minister
OFWAT	Office of Water Services
ONS	Office for National Statistics
pass-km	Passenger kilometre
ProdCom	Products of the European Community
PV	Photovoltaics
RPG	Regional Planning Guidance
SIC	Standard Industrial Classification
SITC	Standard International Trade Classification
Sq. m.	Square metre
Sq. km.	Square kilometre
SWRA	South West Regional Assembly
SWRDA	South West Regional Development Agency
SWRRG	South West Regional Research Group
t	Tonne
TCA	Total Carbon Audit
™	Trademark
UK	United Kingdom
WBCSD	World Business Council for Sustainable Development
WEAF	West of England Aerospace Forum
WEEE	Waste electrical & electronic equipment

# Glossary

- Ancillary flow** - A term applied to certain hidden flows. This is the material that is removed from the natural environment along with the economically useful material, for instance the biomass that is removed from forests to obtain useful wood.
- Apparent consumption** - Production plus imports minus exports of a product or material over a defined time period. This equates to the consumption of that material or product within the region being examined, and consists of additions to stock and direct consumption.
- Biofuel** - A gaseous liquid or solid fuel that is rendered from raw biological material (plants, sewage, dry waste, cane sugar or wood pulp) through combustion or fermentation.
- Carbon intensity** - Carbon intensity is the ratio of CO<sub>2</sub> emissions to GDP.
- Composting** - The aerobic process by which biologically degradable wastes are broken down to form a stable material containing organic matter and plant nutrients.
- Combined heat & power (CHP)** - An energy service provided by an on site generator plant (normally with heat recovery).
- Conversion factor** - A co-efficient used, in this case, to convert between systems of units.
- Degraded land** - A composite term. Degraded land has no single readily identifiable feature, but instead describes how one or more of the land resources (soil, water, vegetation, rocks, air or climate) has changed for the worse.
- Direct energy** - Energy consumed, as opposed to embodied or indirect energy.
- Double counting** - In a resource flow analysis, double counting can best be illustrated by using paper as an example. Paper will go through many stages of production until it becomes the final product we might read (a book) or use (office paper). Economic data can track these sequential processes and report the financial value of each stage. However, it is still the same paper, and for resource accounting purposes this presents a risk of double counting. For the purposes of this study, only the final product has been counted, all intermediate products have been removed.
- Earthshare** - The average amount of global resources available per person. To calculate an earthshare, the total available land and sea area of the planet is divided equally among the current global population. It is estimated that the current earthshare is 1.9 gha (Loh, 2002). If everyone lived within his or her earthshare, we would achieve 'one planet lifestyles'.
- Ecological footprint** - The ecological footprint is a sustainability indicator which expresses the relationship between humans and the natural environment. The ecological footprint accounts the use of natural resources. It is a 'snapshot' measure and typically refers to average annual consumption.
- Embodied (incorporated)** - When the mass of a material becomes incorporated with another material or materials during a manufacturing process, and becomes a different material or product. Embodied energy in a commodity is the energy used (from all sources: electricity, liquid and solid fuels to provide heat, light and/or power) during its entire life cycle for manufacturing, transporting, use and disposal.
- Gross Domestic Product (GDP)** - A measure of the total flow of goods and services produced over a specified time period. It is obtained by valuing outputs of goods and services at market prices.
- Gross Value Added (GVA)** - Measures the contribution to the economy of each individual producer, industry or sector in the United Kingdom. GVA is used in the estimation of GDP, which is a key indicator of the state of the whole economy.
- Global hectares (gha)** - One global hectare is equivalent to one hectare of biologically productive space with world average productivity.
- Hidden flow** - A flow of a material that will not enter the economy. Hidden flows occur at the harvesting or extraction stage of the material cycle, such as dead fish caught and discarded during shellfish harvesting. The hidden material flow has two components: ancillary material flow and excavated/disturbed flow.
- Incineration** - A treatment technology used to destroy waste by controlled burning at high temperatures.
- Inert** - Inert waste is chemically non-reactive, non-combustible, non-biodegradable and non-polluting waste, for example bricks, masonry, rubble, sand, stone and hardcore.
- Mass balance** - A study that quantifies the flow of a material or materials in a defined situation over a period of time. The underlying principle is the fundamental physical law that within a closed system the total mass is constant. There may be movement of mass and transformation of mass into different forms, but it is not created or destroyed, therefore the mass moving into the system should equal the mass moving out of the system.
- Material** - A substance or an object that can be classed as primary production, such as agricultural crops, fishing and mineral extraction.
- Overburden (excavated and/or disturbed material flow)** - The material that is moved or disturbed in order to obtain the useful resource, or the material that is moved to create or maintain infrastructure.
- Passenger kilometre** - One person travelling one kilometre.
- Per capita** - refers to per person or resident of the South West.
- Personal transport** - Transport carrying passengers, as opposed to freight.
- Product** - The European Union (EU) common basis by which industrial production statistics for mining and quarrying and manufacturing (section D of the NACE Rev. 1 (Statistical Classification of Economic Activities in the European Community)) are collected throughout the European Union. The ProdCom reports provide import, export and manufacturing sales data for 4,800 products for the whole of the UK by an eight-digit code.
- Products** - Materials in final processed form or created by the combination of two or more different materials. There are two main types of products: Intermediate: A product that is further processed or incorporated into another product before being sold to the consumer. Final: A product that does not require further processing and can be sold in its current form to the consumer.
- Proxy** - A method normally used to compensate for a lack of raw data. It is an estimation derived from an existing data set using a statistical modifier. For example, deriving local water consumption data by using average per capita consumption of a region in which the locality is part.
- Recycling** - The process of collecting, sorting, cleansing, treating and reconstituting materials that would otherwise become waste, and returning them to the economic stream as raw materials for new, reused or reconstituted products.
- Resource flow analysis** - A systematic methodology used for tracking the flow of materials through a country, region, city or organisation. The outcomes of a resource flow analysis provide an opportunity for a better understanding of how and where to target activities to manage material consumption and minimisation (see Griffiths & Lewis, 2004 and Linstead et al., 2003).
- Resources** - Energy, materials and products, water and land that have a useful purpose to humanity either in their original form or when embodied into a final product.
- Reuse** - The recovery or reapplication of a product for uses similar or identical to its original application, without manufacturing or preparation processes that significantly alter the original product.
- SIC (Standard Industrial Classification)** - SIC was first introduced into the United Kingdom in 1948 for use in classifying business establishments and other statistical units by the type of economic activity in which they are engaged. The classification provides a framework for the collection, tabulation, presentation and analysis of data and its use promotes uniformity.
- Stock** - A term used to describe products that are not discarded by a region during the study year. Examples of products that remain as stock could include: addition of resources to the built environment, for example, new buildings, and durable goods that remain in use beyond the timescale of the study year, for example, mechanical equipment.
- Wastewater** - Spent or used water from a home, community, farm, or industry that contains dissolved or suspended matter.

# About the authors

**Nicky Chambers** is Co-Director of Best Foot Forward. An environmental management and communication specialist, she has previously worked with industry and policy makers. Anticipating the need for resonant communication and robust metrics, she has been heavily involved with the development and promotion of resource efficiency indicators such as ecological footprinting since 1994. She has led several regional resource flow and ecological footprint projects including *Island State*, *City Limits*, *Scotland's Footprint*, *Material Health* and analyses for organisations, including *Ecological Footprint Analysis: Towards a Sustainability Indicator for Business*. She is co-author of *Sharing Nature's Interest*.

**Rachel Child** is a consultant with Energy for Sustainable Development (ESD), working on a range of activities designed to provide practical solutions to climate change by reducing CO<sub>2</sub> emissions. These include working with businesses, local authorities, housing associations and communities to develop strategies that will provide economically viable solutions, particularly through energy efficiency measures and renewable energy technologies. Rachel is particularly interested in methods of alleviating fuel poverty in conjunction with reducing carbon dioxide emissions in domestic dwellings.

**Nicola Jenkin** is a projects manager at Best Foot Forward. She is involved in the management of resource flow, mass balance and ecological footprint projects, research and publications. Her main area of interest is in education and communication for sustainable development in industry, business and local authorities, having developed a background in this field in South Africa. She has managed, amongst others, the *Material Health* and *Scotland's Footprint* projects. She was also involved in *City Limits*, and produced Best Foot Forward's award-winning *Environmental Report 2002*.

**Kevin Lewis** is the senior researcher for Best Foot Forward. He is a principal specialist in ecological footprint methodology and has applied the concept in a wide variety of applications. He comes from an ecological background and for his degree specialised in and focussed on human interactions with the environment, using life cycle and ecological footprint analyses. He has worked on a number of important footprint projects, and has been involved in or produced a variety of publications, notably *Scotland's Footprint*, *Material Health*, *City Limits*, *Island State*, *The Footprint of Wales*, *Sharing Nature's Interest* and *Ecological Footprint Analysis: Towards a Sustainability Indicator for Business for ACCA*.

**George Vergoulas** is a researcher at Best Foot Forward, primarily focusing on resource flow analyses at a regional and sectoral level. He is also involved in ecological footprint at a local level in the UK. Some of the projects he has worked on include *Material Health*, *Scotland's Footprint*, *City Limits* and ecological footprints of Jersey, Angus, Essex, Buckinghamshire and East Renfrewshire. He has a background in environmental management and technology, and is particularly interested in sustainable resource consumption issues and their links to supply chain management.

## Further information

For this project, different research responsibilities were allocated between Best Foot Forward and Energy for Sustainable Development (ESD). If you require further information on certain components covered in the report, please contact the relevant researchers, as listed below:

**For direct energy** contact Rachel Child at ESD: [rachel@esd.co.uk](mailto:rachel@esd.co.uk)

**For materials and products, food, waste, personal transport, water and built land** contact George Vergoulas at Best Foot Forward: [george@bestfootforward.com](mailto:george@bestfootforward.com)

**For general information** contact the Project Manager, Nicola Jenkin at Best Foot Forward: [nicola@bestfootforward.com](mailto:nicola@bestfootforward.com)

## Other ecological footprint studies

**Best Foot Forward's Environmental Report 2004.** Use of ecological footprinting in a corporate context. [www.bestfootforward.com](http://www.bestfootforward.com)

**City Limits:** *A resource flow and ecological footprint analysis of Greater London.* [www.citylimitslondon.com](http://www.citylimitslondon.com)

**Island State:** *An ecological footprint analysis of the Isle of Wight.* [www.bestfootforward.com](http://www.bestfootforward.com)

**Material Health:** *A mass balance and ecological footprint analysis of the NHS in England and Wales.* [www.materialhealth.com](http://www.materialhealth.com)

**Northern Limits:** *A resource flow analysis and ecological footprint for Northern Ireland.* [www.northern-limits.com](http://www.northern-limits.com)

**Scotland's Footprint:** *A resource flow and ecological footprint analysis of Scotland.* [www.scotlands-footprint.com](http://www.scotlands-footprint.com)

**Sharing Nature's Interest:** *Ecological footprints as an indicator of sustainability.* [www.ecologicalfootprint.com](http://www.ecologicalfootprint.com)

## Project partners

### Biffaward

[www.biffaward.org](http://www.biffaward.org)

In December 1997, Biffa Waste Services agreed to donate landfill tax credits to the Royal Society for Nature Conservation (RSNC) to administer under the fund name Biffaward. Grants made from the fund currently amount to more than £63 million, supporting many worthwhile environmental projects.



### South West Regional Development Agency

[www.southwestrda.org.uk](http://www.southwestrda.org.uk)

The South West of England Regional Development Agency (SW RDA) was established in 1999. Its most important responsibility is to ensure the long-term economic success of the region through providing conditions in which businesses can thrive, and to encourage individuals, businesses and communities in areas with greater social and economic needs to take advantage of new opportunities. The SW RDA is also responsible for providing regional economic leadership by gathering and sharing best intelligence, and promoting the South West both in the UK and abroad.



### South West England Environment Trust

[www.sweet-uk.com](http://www.sweet-uk.com)

The South West England Environmental Trust (SWEET) is a dynamic organisation whose primary aim is to ensure that monies made available through the Landfill Tax Credit Scheme (LTCS) are used to the maximum benefit of all those involved. Their role is to assist projects and sponsors to achieve sustainable waste management and improve the social, economic and natural environment of local communities at local, regional and national level.

### Best Foot Forward Ltd

[www.bestfootforward.com](http://www.bestfootforward.com)

Best Foot Forward Ltd (BFF) is a sustainability consultancy based in Oxford, specialising in sustainability metrics, resource flow and ecological footprint analyses. BFF have developed the EcoIndex™ and Stepwise™ methodologies, based on ecological footprint, which can be used to calculate the environmental impact and sustainability of a product, organisation, process, lifestyle or region. BFF's ecological footprint of the Isle of Wight was voted Overall Winner at the Biffaward Awards 2001, and their Environmental Report 2002 won an ACCA UK Award for Best SME reporter in the Environmental Reporting Category. Some other publications include: *Scotland's Footprint*, *Material Health* (a mass balance and ecological footprint of the NHS) and *City Limits* (a resource flow and ecological footprint of Greater London, and a Biffaward 2003 finalist in the R&D category).



### The Rudloe Centre for Climate Change Solutions

[www.rudloecentre.co.uk](http://www.rudloecentre.co.uk)

A joint venture between Energy for Sustainable Development Ltd. (ESD), the University of Bath and Alkemi Park plc., the Rudloe Centre seeks to produce low carbon technological innovations to mitigate climate change.



### Energy for Sustainable Development (ESD)

[www.esd.co.uk](http://www.esd.co.uk)

Energy for Sustainable Development Ltd (ESD) is Europe's leading climate change and sustainable energy company with a specialist UK staff of 45 across four regional locations, and offices in Nairobi and Sofia. Affiliates in every European country and in most commerce regions beyond. ESD works across the carbon climate change market. Shaping the carbon market through policy, market mechanism development and trading. Building low carbon strategies for commercial and public clients and managing its effective delivery through low carbon and sustainable energy implementation. Helping clients to realise the new carbon market opportunities in the UK, Europe and internationally.

