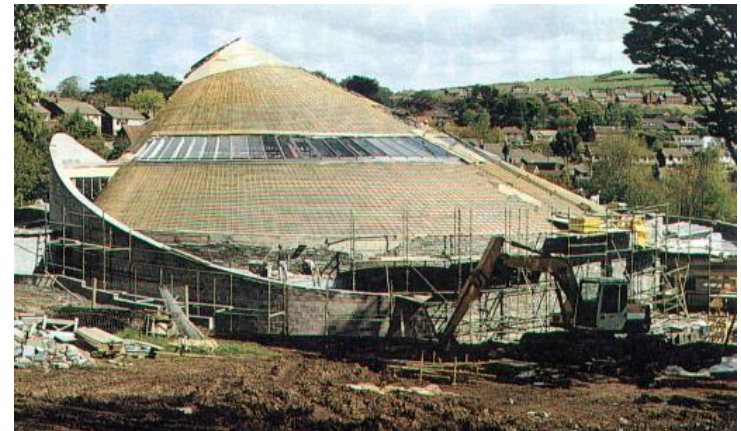


BSc Environmental Conservation



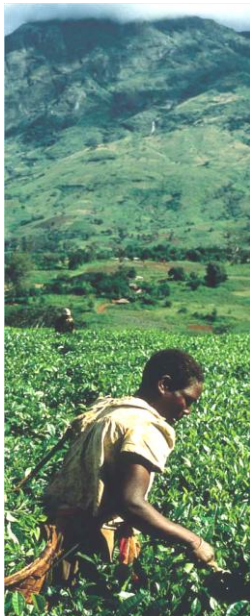
How Can We Measure Sustainable Development?



Early ideas of sustainable development centred around:

social progress

protection of the environment



prudent use of natural
resources

high and stable levels of
economic growth and
employment

Previously we identified a strategy for achieving sustainable development:

- Key priorities:

Sustainable Consumption and Production

Climate Change and Energy

Natural Resource Protection and Environmental Enhancement

Sustainable Communities

Further definitions of sustainable development were extracted:

Sustainable development includes maximising efficiency, minimising waste, working towards a balanced environment and an improved quality of life for all.



Sustainable development should be centred around the ideals of ethic and economic perspectives. However, development is far too often an excuse for environmental degradation to be identified by the promise of mitigation.



[Sustainable Development is]... development which can be carried on indefinitely in time as it in no way depletes resources needed by itself or anything else, now or in the future.



The Bellagio Principles outlined a number of key areas for gauging progress towards sustainable development; for example:

the need for a clear definition of
sustainable development

the importance of viewing
sustainability holistically

the importance of time and scale.

Sustainable objectives however, are wide-ranging

- to deliver them one needs to focus on specific issues, for example;
 - an ecological system
 - a soil fertility system, or
 - an educational system
- a possible way forward is via Bellagio's fifth to ninth principles:



Progress towards sustainable development should be based on the measurement of a limited number of indicators based on standardised measurement.

Methods and data employed for assessment of progress should be open and accessible to all.

- ➡ Progress should be effectively communicated to all.
- ➡ Broad participation is required.
- ➡ Allowance should be made for repeated measurement in order to determine trends and incorporate the results of experience.

The health of an ecological system, for example, might best be judged using the following approaches:



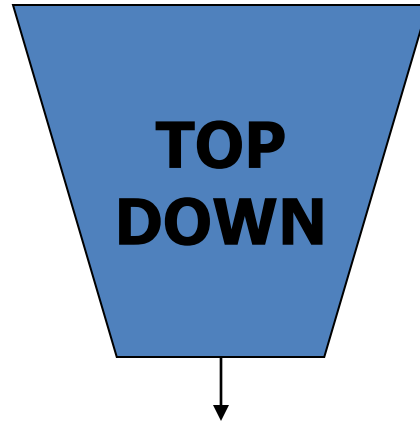
TOP DOWN



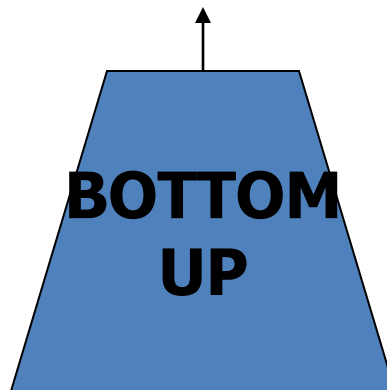
BOTTOM UP



The Top Down Bottom Up Approaches



ENVIROMENTAL INDICATORS



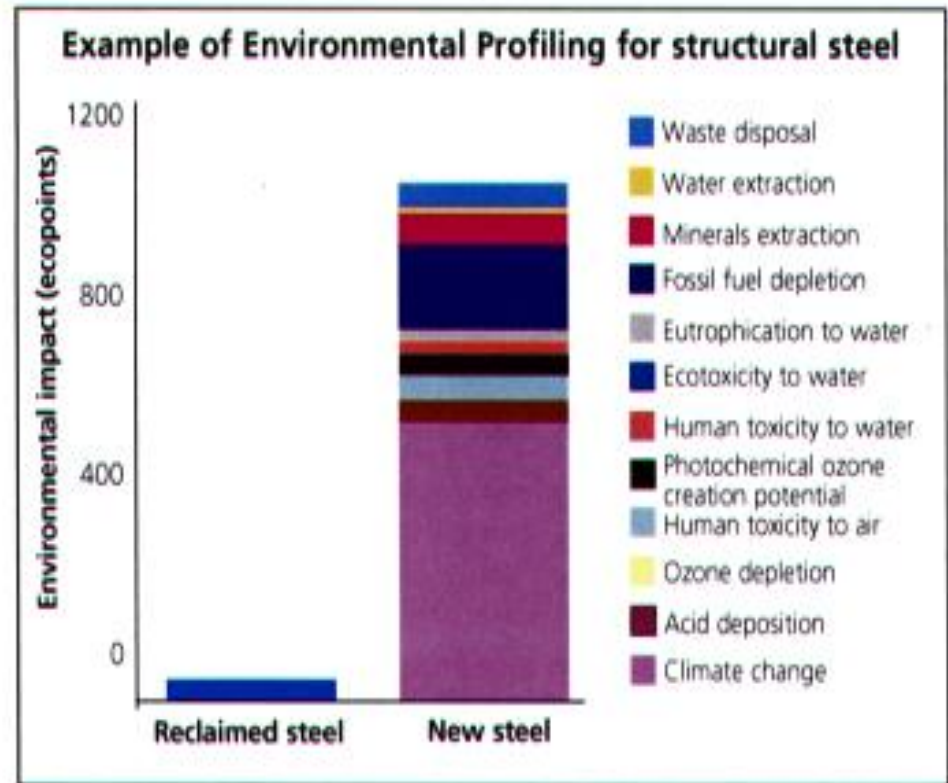
Measuring Construction



- Embodied energy
- Embodied CO₂
- BRE Environmental Profiling
- Eco-footprinting
- Biodiversity indicators
- KPIs
- SD Indicators

BRE Environmental Profiling

Uses Life Cycle Assessment complying with an international established approach for analysing impacts of products and processes.

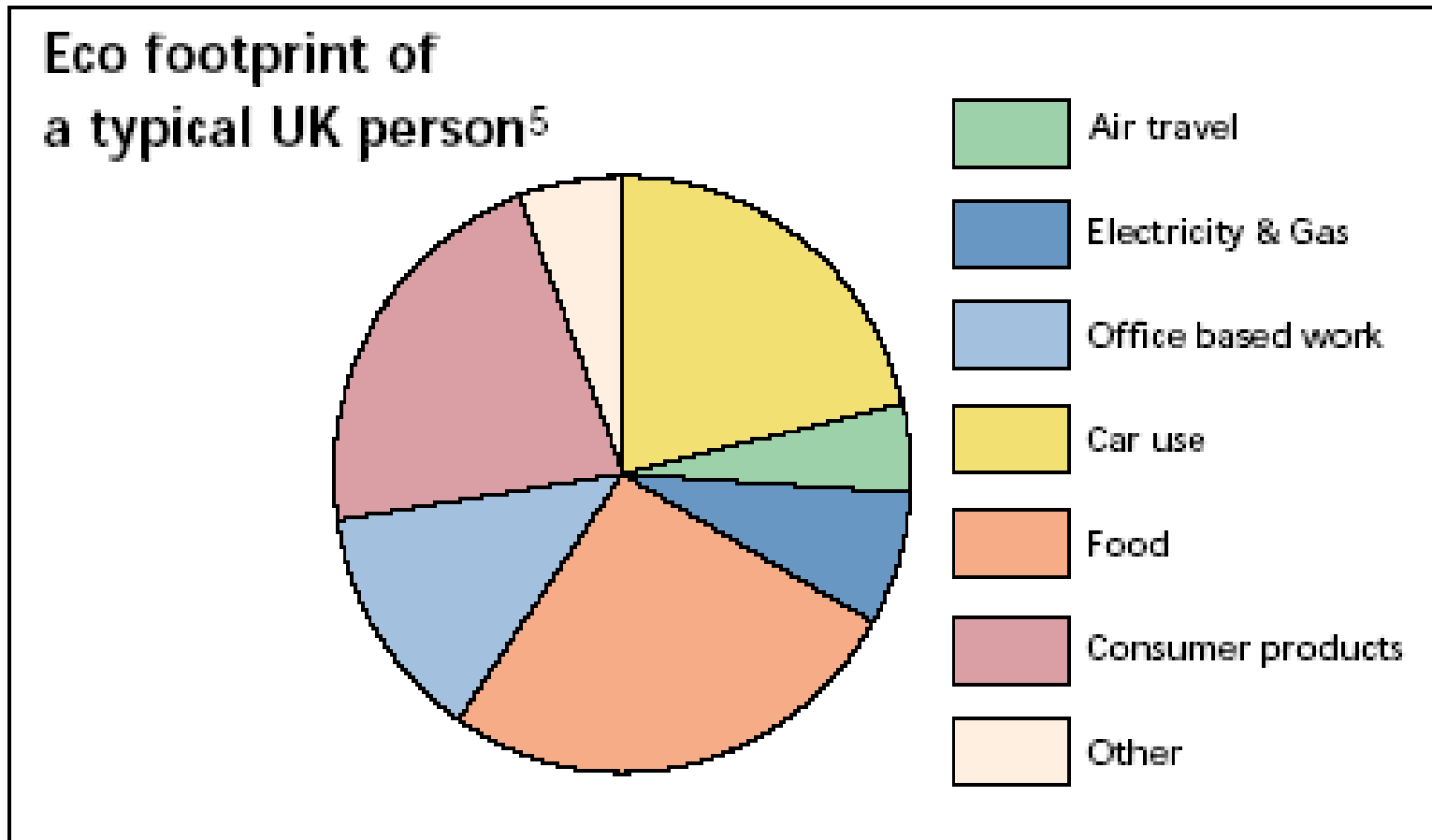


BRE Environmental Profiling



- Climate change
- Fossil fuel depletion
- Ozone depletion
- Human toxicity to air
- Human toxicity to water
- Waste disposal
- Water extraction
- Acid deposition
- Ecotoxicity
- Eutrophication
- Summer smog
- Minerals extraction

Eco-footprinting



Impact on biodiversity – product and construction process

Purpose

To determine the overall impact on biodiversity of the completed product/facility and the construction process.

Definitions

There are two indicators – one for the product/facility and one for the construction process.

1. How satisfied was the client that the impact on biodiversity was taken into account in the finished product/facility (this could be determined in consultation with the ecology or project manager), using a 1 to 10 scale where:
 - 10 = thorough consideration of biodiversity
 - 8 = good level of consideration of biodiversity
 - 5/6 = fair consideration of biodiversity
 - 3 = some consideration of biodiversity
 - 1 = no consideration of biodiversity.
2. How satisfied was the client that the impact on biodiversity was controlled during the construction process (this could be determined in consultation with the ecology or project manager), using a 1 to 10 scale where:
 - 10 = very effective control
 - 8 = good control
 - 5/6 = fair control
 - 3 = little control
 - 1 = no effective control.

Method

During construction (for the Construction process KPI) and at completion of the project (for the Product KPI), carry out a survey with the client to determine how satisfied the client was that the impact on biodiversity was taken into account in the finished product/facility and controlled during the construction process on a scale of 1 to 10.

Scoring the impact on biodiversity KPIs

Use the following checklists of actions to arrive at a score between 1 and 10. Each box ticked gives a score of one point. The minimum possible score is "1", which indicates that no consideration of biodiversity has been made. Total the boxes ticked to arrive at the project's score.

Biodiversity indicators

Recommended indicators:

- Impact on biodiversity
 - Product

- Impact on biodiversity
 - Construction process

- Area of habitat retained / created

Impact of Biodiversity: Habitats

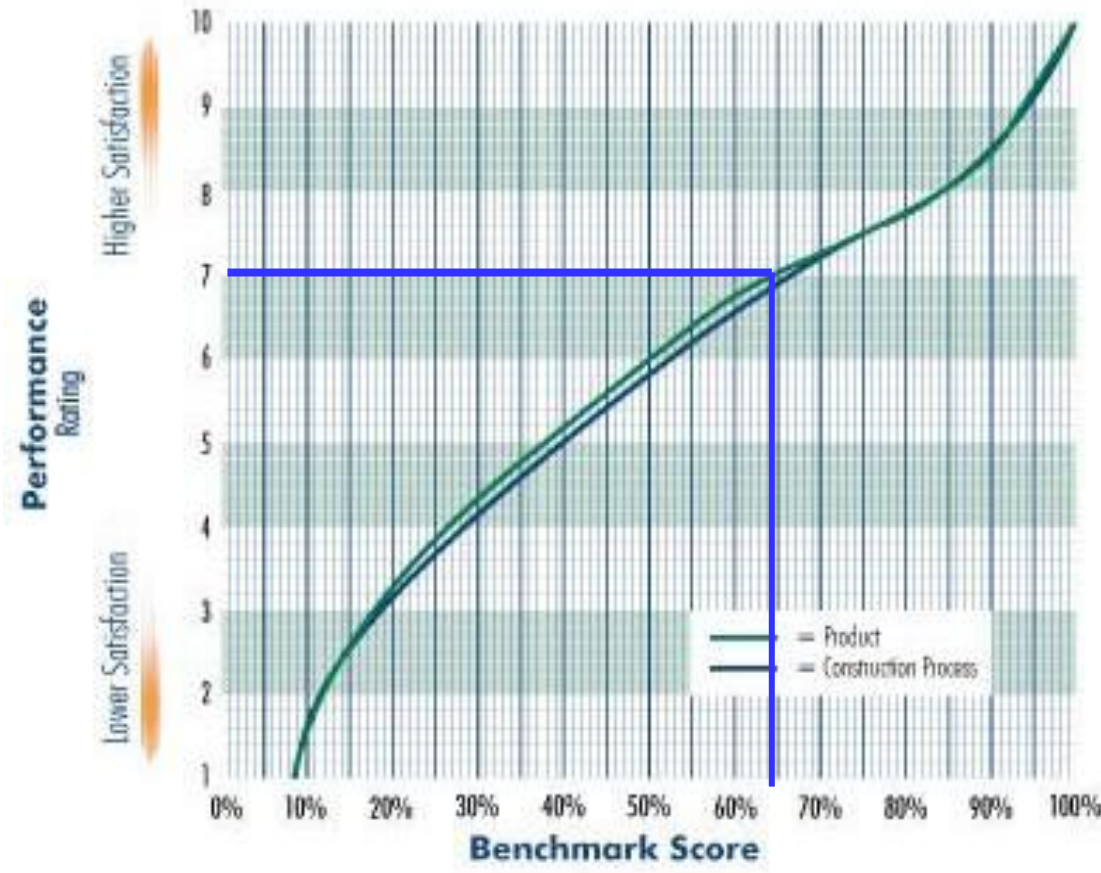
- ancient/species-rich hedgerows.
- industrial sites such as demolition sites, disused railway lands or unexploited
- industrial land that have been derelict and undisturbed for a sufficiently long period
- to enable the establishment of a range of native species
- fens



lowland meadows
heathland
beech and yew woodland
native pine woodland
upland oak wood
upland mixed ash woods
reedbeds.



Impact of biodiversity



Plot the measured performance on the vertical axis

Read across to the performance relevant line

Read down to the horizontal axis

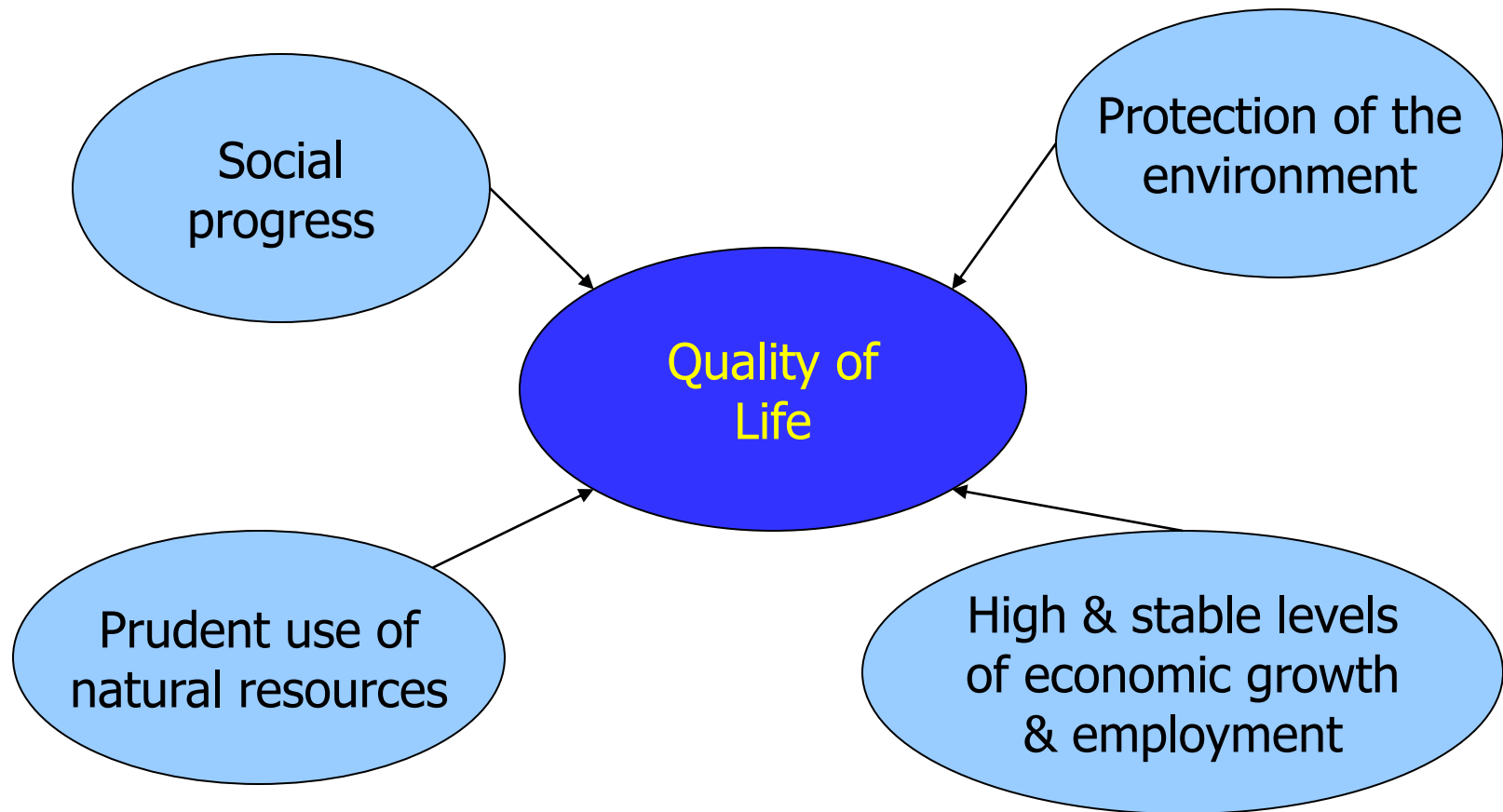
KPIs: judging client satisfaction

Indicator	Type	Definition
Client satisfaction Product – standard criteria	Headline	How satisfied was the client with the finished product.
Client satisfaction Service – standard criteria	Headline	How satisfied was the client with the service of the advisor.
Client satisfaction – client – specified criteria	Operational	How satisfied was the client with certain client – specified criteria

Key criteria for indicators

- primarily national in scope;
- relevant to assessing sustainable development progress;
- understandable, clear, and unambiguous, to the extent possible;
- within the capabilities of national governments to develop;
- conceptually sound;
- limited in number, but remaining open-ended and adaptable to future needs;
- broad in coverage of Agenda 21 and all aspects of sustainable development;
- representative of an international consensus to the extent possible; and dependent on cost effective data of known quality.

We now return to four key objectives of Sustainability



So far our studies have suggested that these objectives are indeed broad.

- How for example, might they be delivered?

INDICATORS

Sustainable Development Indicators

- Dependent upon:
 - spatial, and
 - time elements of the system they are attempting to measure.
- For example;
 - State sustainability indicators
 - Control, pressure or driving force sustainability Indicators

STATE INDICATORS

- Here the onus is on the variable itself.
For example;
 - ratio of average female wage to male wage
 - population density
 - access to safe drinking water
 - biological oxygen demand in water bodies
 - forest area change
 - threatened species as a percentage of total native species

CONTROL INDICATORS

- Allows measurement of a process that offers influence on a state SI. For example;
 - unemployment rate
 - population growth rate
 - the rate at which a pollutant is passed into the environment
 - wood harvesting intensity
 - use of pesticides

A third type of indicator has been introduced by the UN,

RESPONSE INDICATORS

Primarily introduced to measure the required progress in the response of governments.

This included achievement of adequate values / targets of both state and control indicators.

European Environment Agency

The Environmental Space Concept:

`...there are limits to the amount of environmental pressure that the Earth's ecosystems can handle without irreversible damage to these systems or to the life support processes that they enable'.

This brought about a three-way classification of indicators...

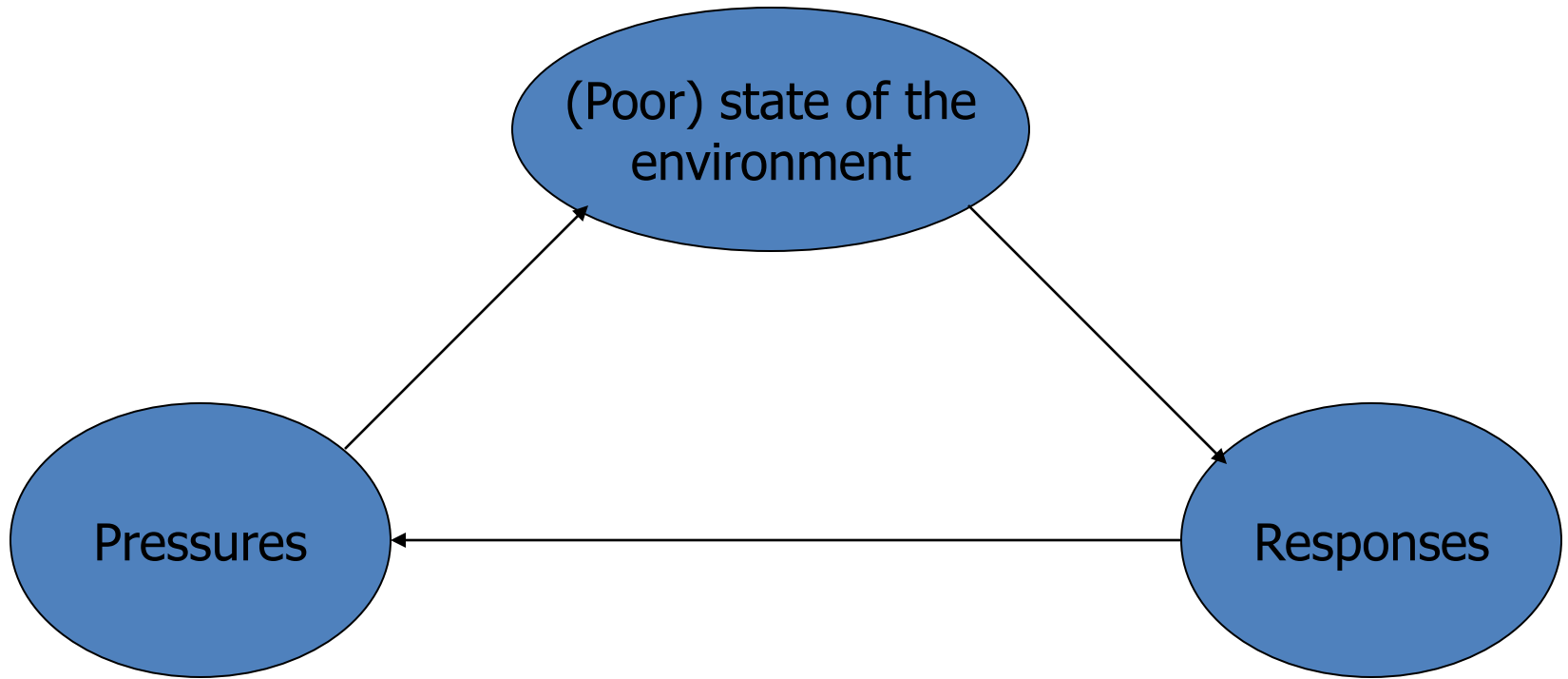
The Pressure - State - Response (PSR) System

- Typically, ***pressures*** may relate to polluting emissions
- ***State*** may be air or water quality, and
- ***Response*** might allude to expenditure on cleaning measures.

In an ideal world the PSR system may be regarded as a chain of casual links...

increased pressures place the environment in a poorer state, which (hopefully) provokes responses, that in turn minimize the pressures - the vicious circle thus becomes a good one!

Or to put it another way...

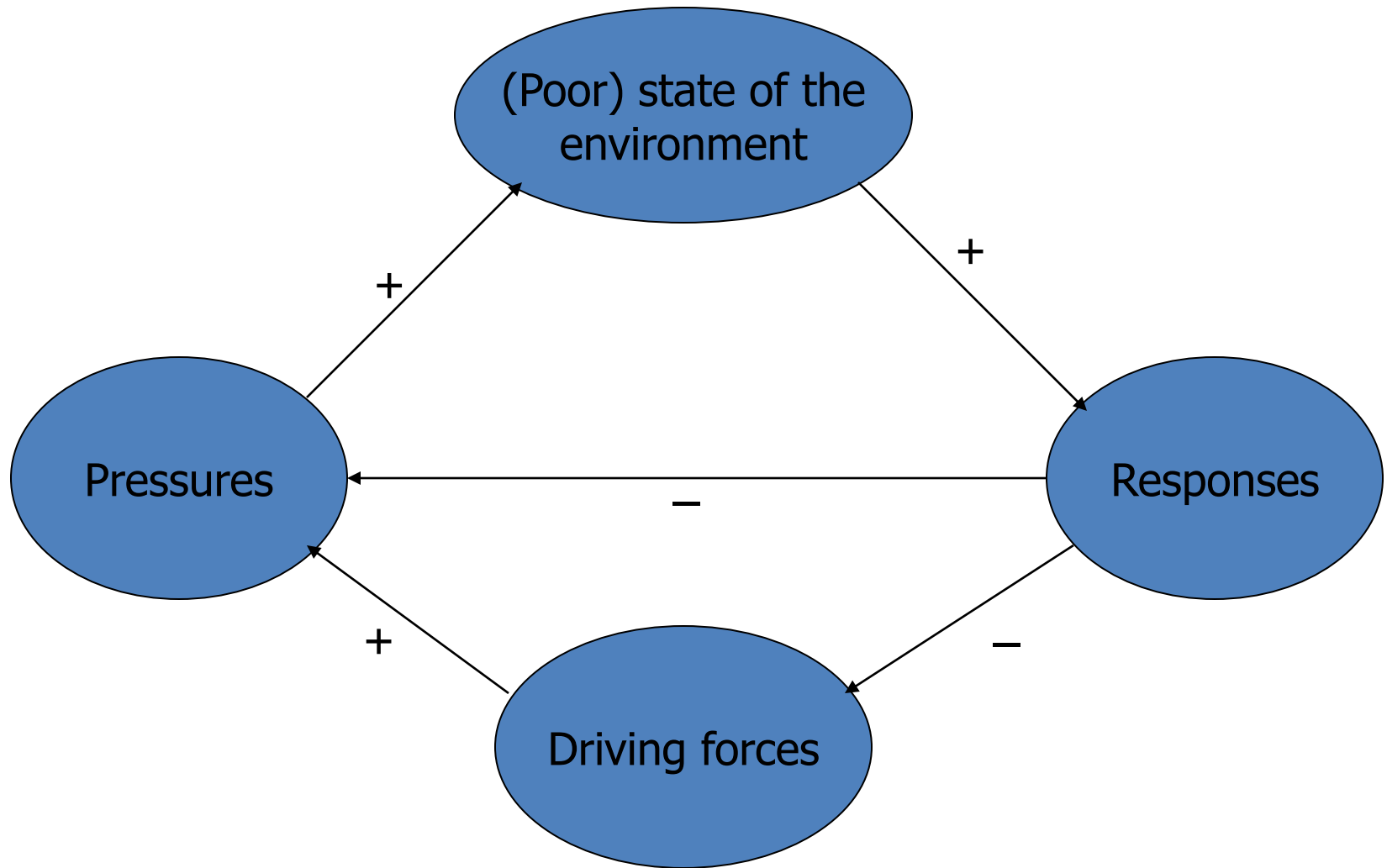


The Relationships between pressures, state and responses

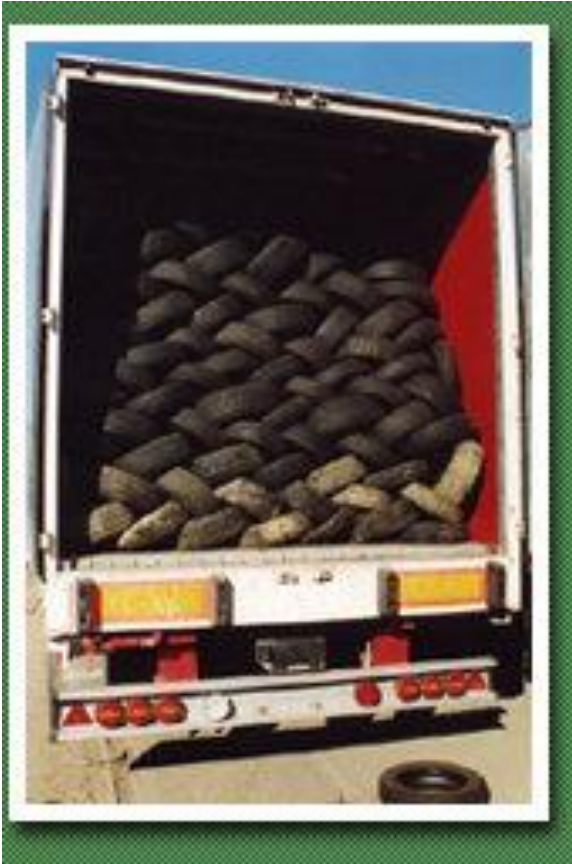
This system was further refined to include a control or driving force indicator

In the EEA indicator system ***driving forces*** refer to economic and other societal developments, for example;

some aspects of resource consumption which may contribute to pressures in the sense of emissions, disturbance etc.



The Relationships between driving forces, pressures, state and responses



What a Waste!

Sustainable Development Indicators - after Rio

- Social aspects of SD
 - combating poverty
 - demographics and sustainability
 - promoting education, public awareness & training
 - protecting & promoting human health
 - promoting sustainable human settlement development

Sustainable Development Indicators - after Rio

- Economic aspects of SD
 - international co-operation to accelerate SD
 - changing consumption patterns
 - financial resources & mechanisms
 - transfer of environmentally sound technology

Sustainable Development Indicators - after Rio

- Environmental aspects of SD - further divided into water, land, atmosphere and waste
 - protection of the quality & supply of freshwater resources
 - protection of the oceans, all kinds of seas & coastal areas
 - integrated approach to the planning & management of land resources

- promoting sustainable agriculture & rural development
- combating deforestation
- conservation of biological diversity
- managing fragile ecosystems: combating desertification & drought
- environmentally sound management of biotechnology
- protection of the atmosphere

- environmentally sound management of solid wastes & sewage-related issues
- environmentally sound management of toxic chemicals
- environmentally sound management of hazardous wastes
- safe & environmentally sound management of radioactive wastes

Sustainable Development Indicators - after Rio

- Institutional aspects of SD
 - integrating environment & development in decision making
 - science for sustainable development
 - national mechanisms & international c-operation for capacity building in developing countries
 - international institutional arrangements

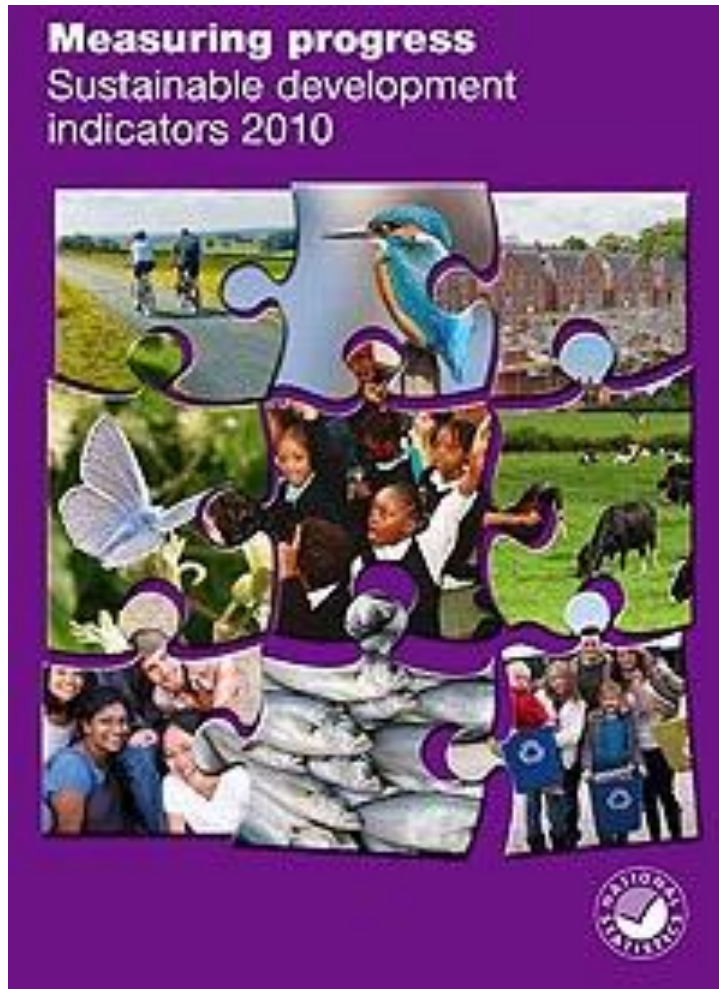
- international legal instruments & mechanisms
- information for decision making
- strengthening the role of major groups

From these categories a set of indicators is determined for the appropriate lists...

Promoting sustainable human settlement development

Driving Force	State	Response
Rate of growth of urban population	Percent of population in urban areas	Infrastructure expenditure per capita
Per capita consumption of fossil fuel by motor vehicle transport	Area and population of urban formal and informal settlements	
	Floor area per person	
Human and economic loss due to natural disasters	House price to income ratio	

The UK Indicator System



- Priority areas
 - Sustainable consumption and production
 - Climate change and energy
 - Protecting natural resources and enhancing the environment
 - Creating sustainable communities and a fairer world

UK Framework Indicators

Indicator number and title		Change since 1990 ¹	Change since 2003	Direction in latest year*
1. Greenhouse gas emissions		✓	✓	✓
13. Resource use		✓	✓	✓
18. Waste arisings		...	✓	✓
20. Bird populations	Farmland	✗	✗	✓
	Woodland	≈	✓	✓
	Seabird	≈	≈	≈
27. Fish stocks sustainability		✓	✓	✓
28. Ecological impacts of air pollution	Acidity	...	≈	...
	Nitrogen	...	≈	...
30. River quality	Biological	✓	≈	≈
	Chemical	✓	✓	✓
32. Economic output		✓	✓	✗
37. Active community participation		...	✗	✗
38. Crime		✓ 1991	✓	✓
40. Employment		≈	≈	✗
41. Workless households		...	≈	✗
43. Childhood poverty	Before housing cost	✓	≈	✓
	After housing cost	≈	≈	
45. Pensioner poverty	Before housing cost	✓	≈	✓
	After housing cost	✓	✓	✓

1Year as shown if not 1990

* Indication only

Indicator number and title		Change since 1990 ¹	Change since 2003 ²	Direction in latest year*
47. Educational attainment		✓	✓ 2004	✓
49. Health inequality	Infant mortality gap	✗ 1994	✓	✓
	Life expectancy gap	✗ 1991	✗	✗
55. Mobility	Walking / cycling	✗ 1995-7	✗	✓
	Public transport use	✓ 1995-7	✓	≈
59. Social justice		...	...	...
60. Environmental equality		...	...	...
68. Wellbeing		...	...	...

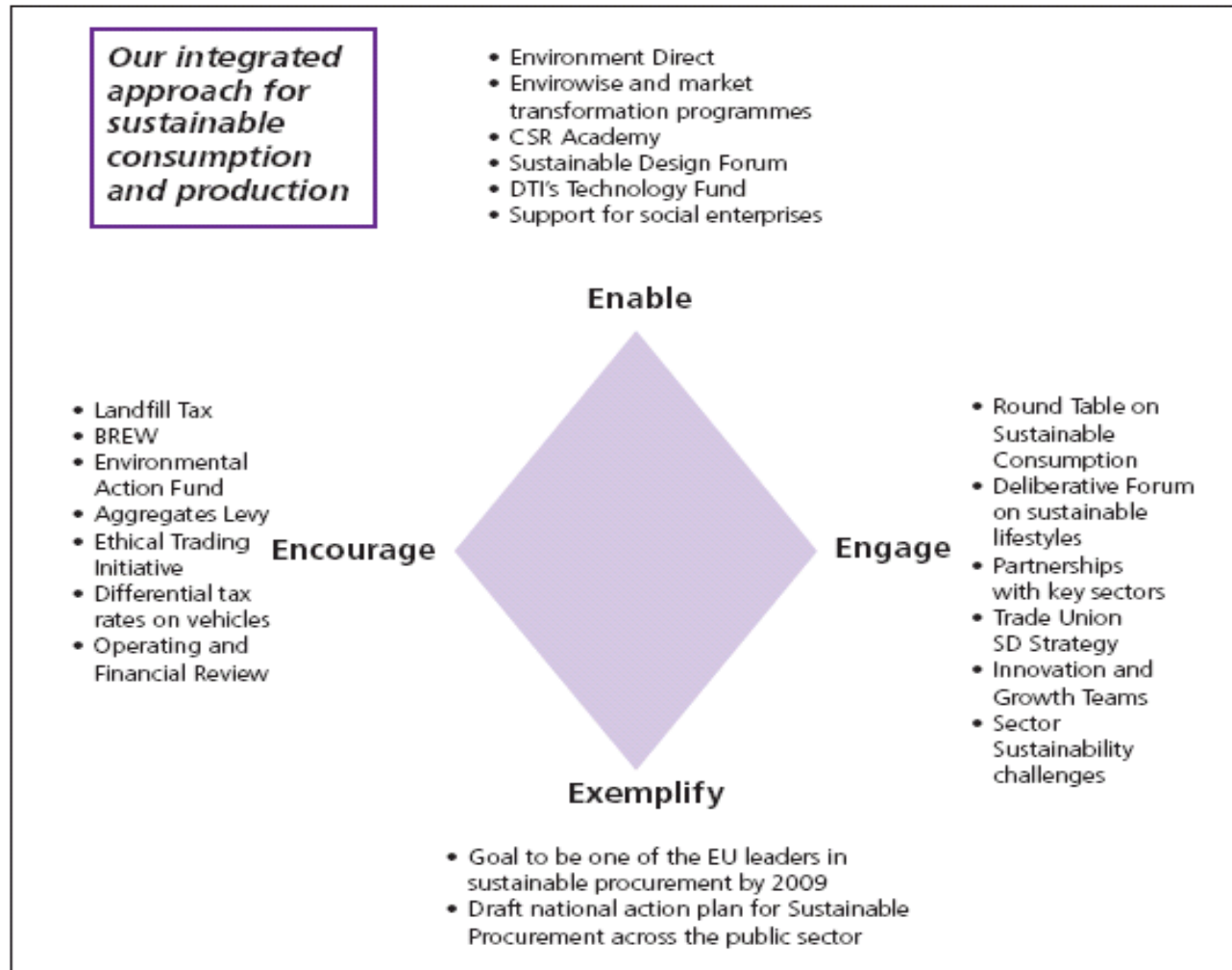
✓ = clear improvement since base year

≈ = little or no change since base year

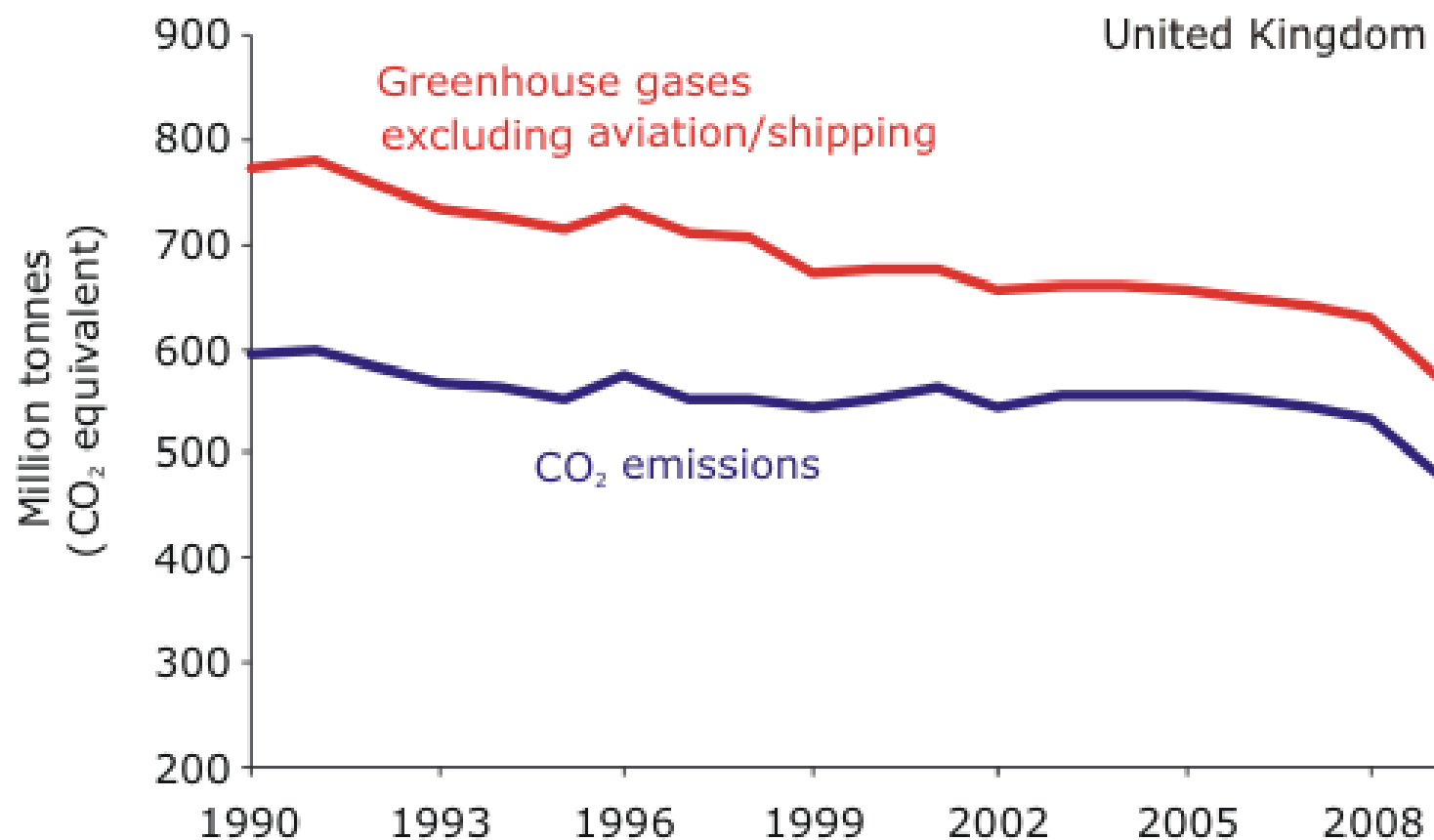
✗ = clear deterioration since base year

... = insufficient or no comparable data

The Four Es Approach



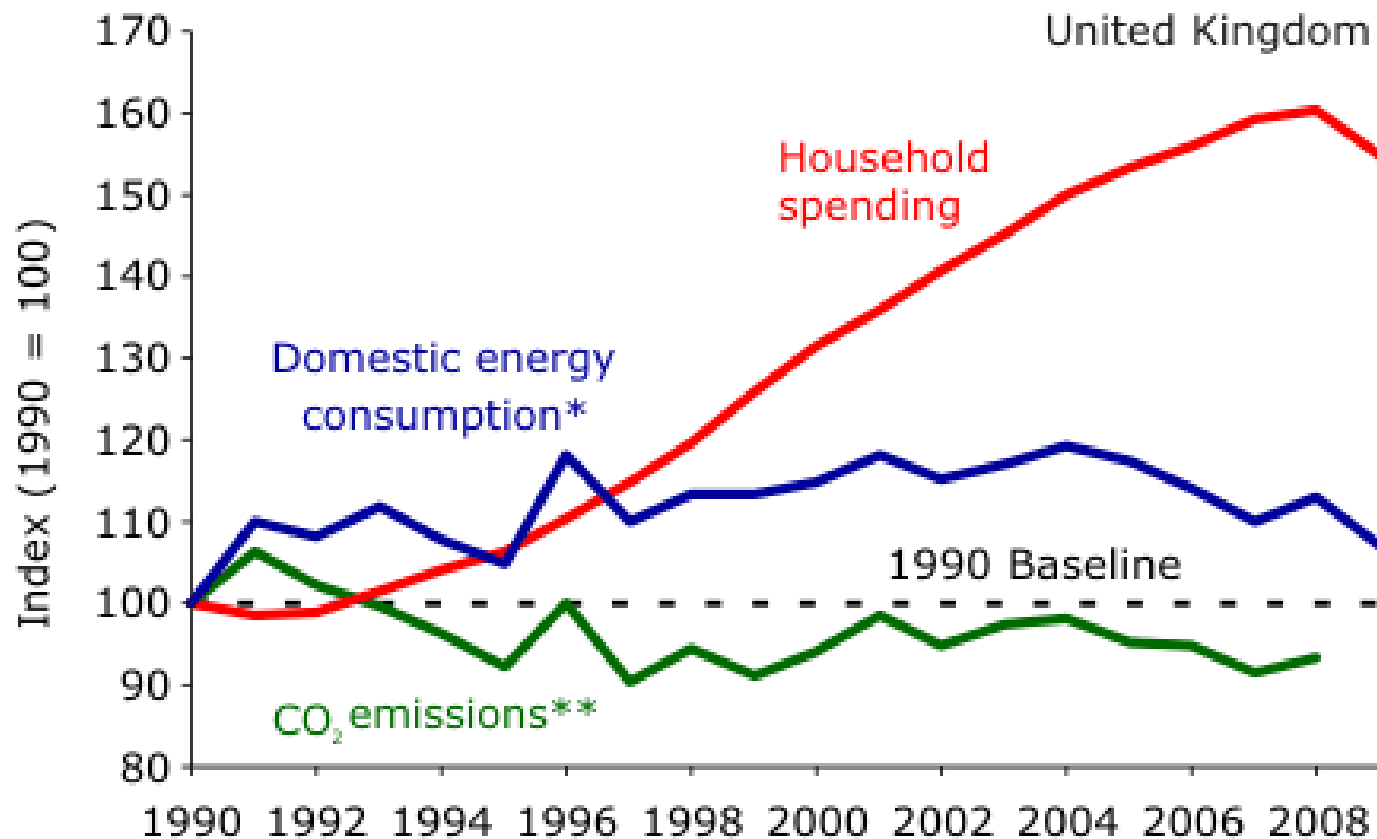
Greenhouse gas emissions and carbon dioxide emissions, 1990 to 2009



Note: 2009 data are provisional.

Source: Defra, DECC, AEA Energy and Environment

Domestic CO2 emissions, domestic energy consumption and household spending, 1990 to 2009

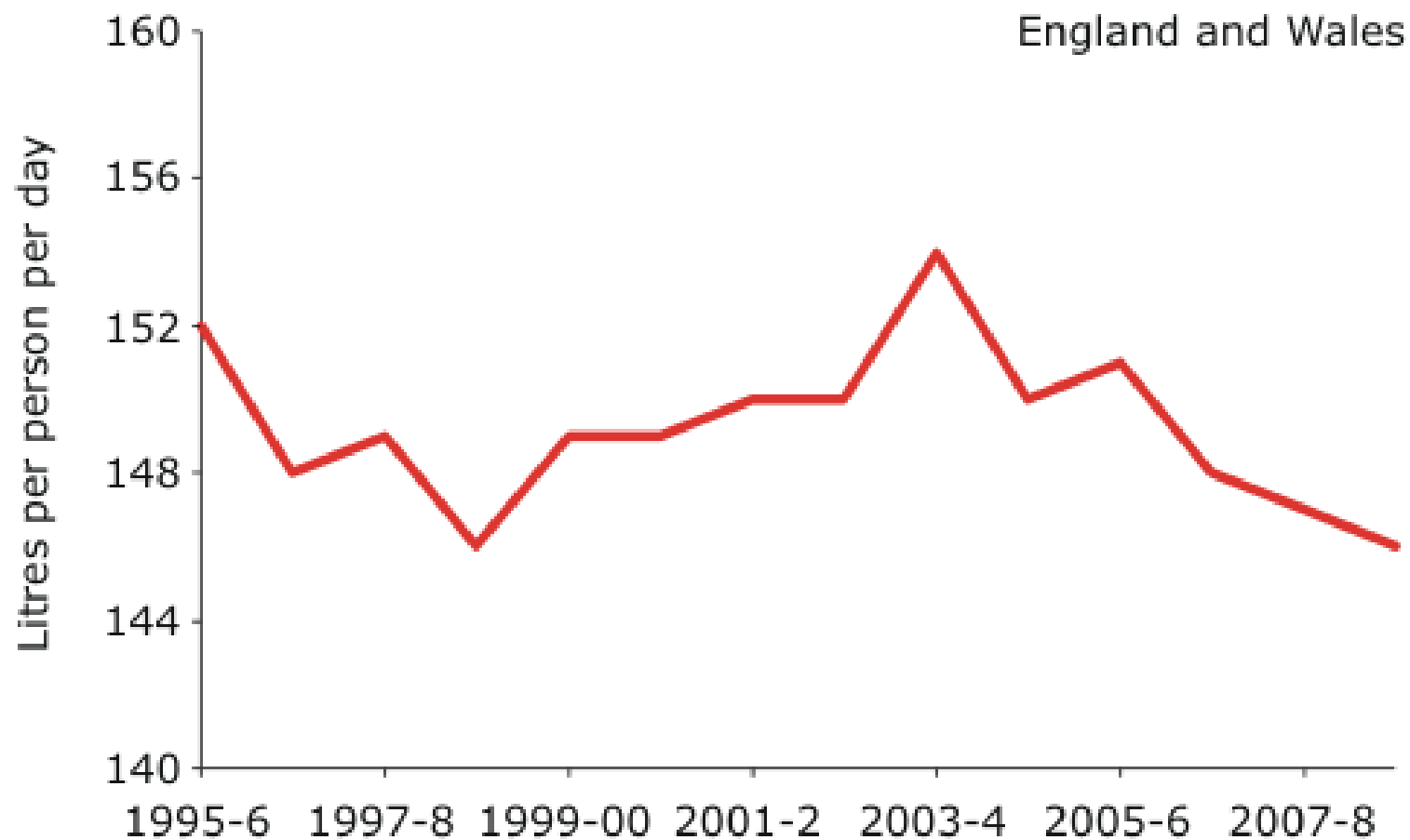


*Electricity, gas, oil and other fuels used in the home.

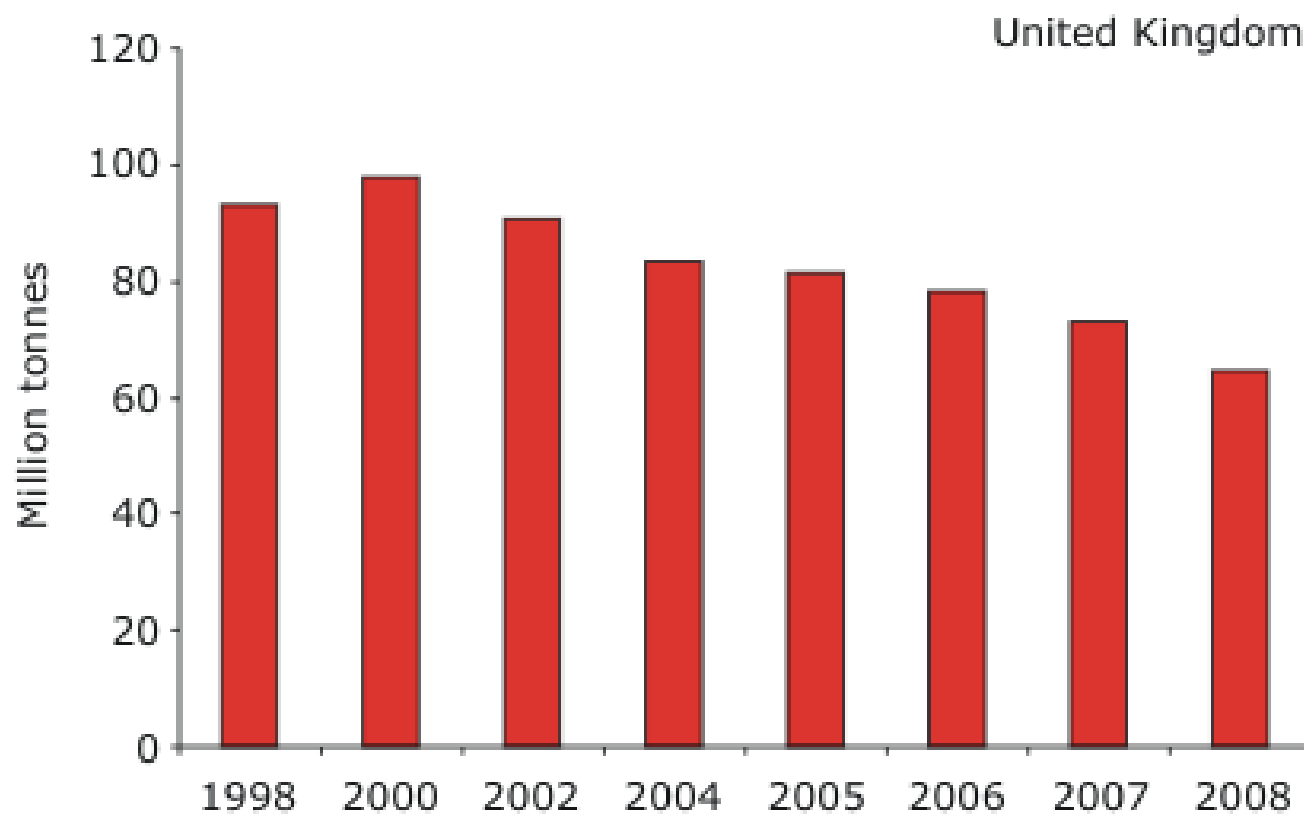
** includes an estimate of share of energy industry emissions

Source: AEA Energy and Environment, DECC, ONS

Domestic water consumption: Litres per person per day, 1995-6 to 2008-9



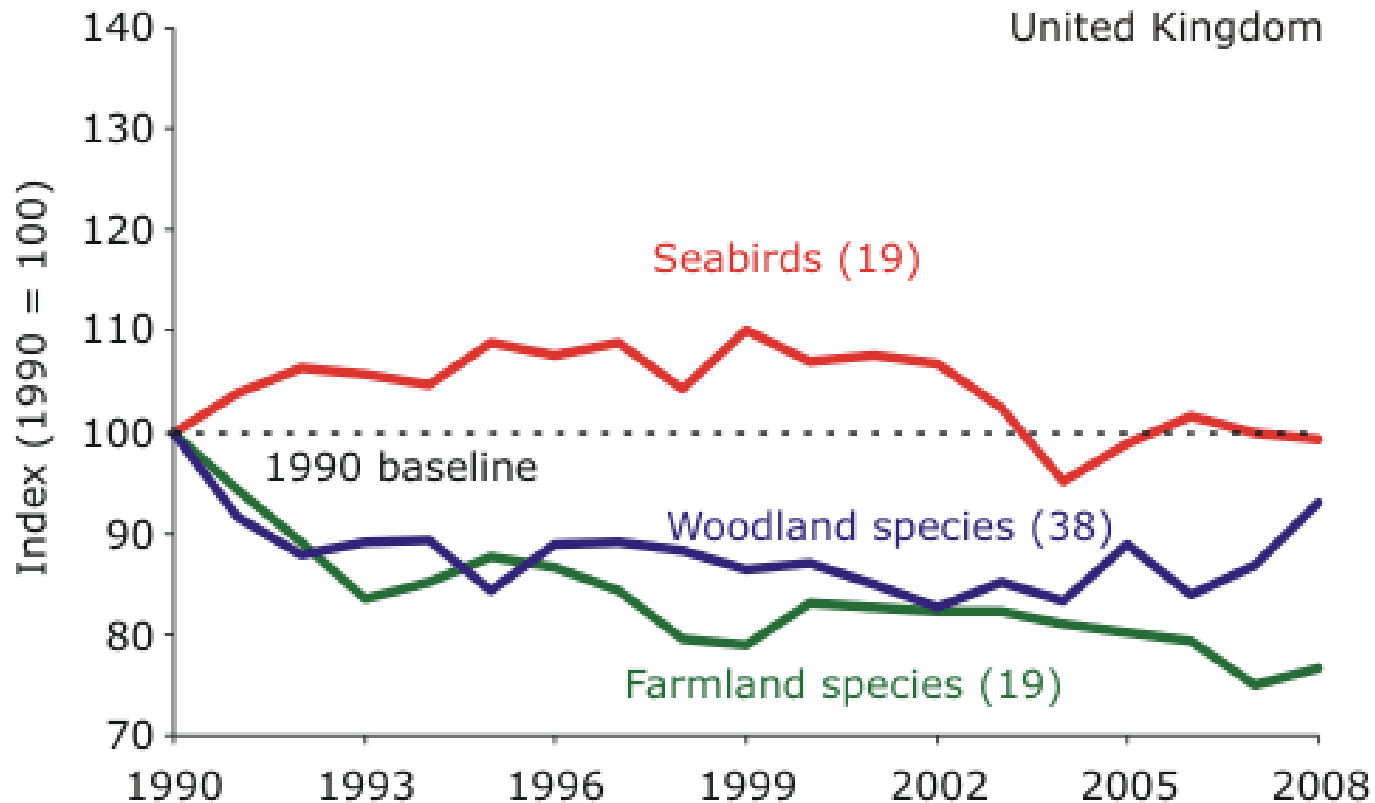
Source: OFWAT



Note: UK total is compiled using figures from constituent countries. Before 2005, England and Wales data were on a financial year basis. In combining figures from all countries for 1998-2004, these data have been allocated to the calendar year in which the majority of the financial year fell. The contributing figures for Northern Ireland are estimates, excluding 2004 and 2006, which are actual figures.

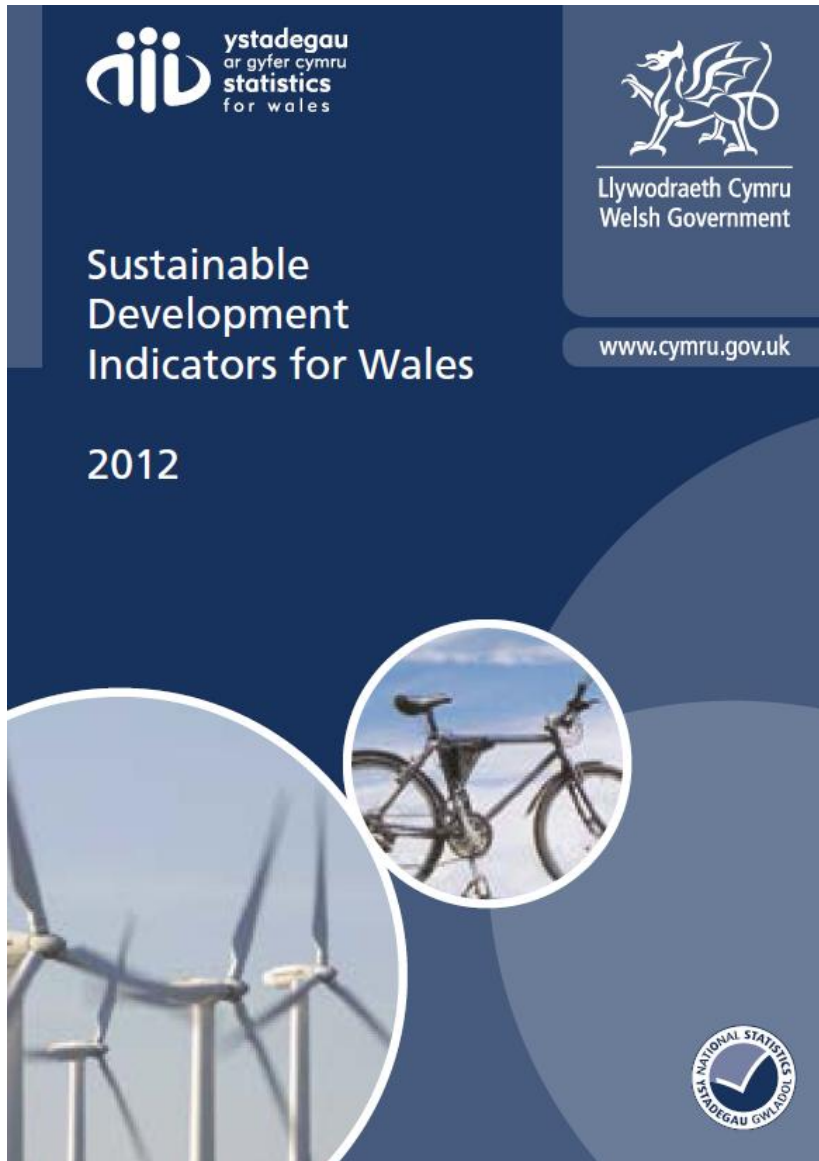
Source: Defra

Bird population indices farmland birds, woodland bird and seabirds, 1990 to 2008



Note: Figures in brackets give the number of species included in each category.

Source: RSPB, BTO, JNCC, Defra



Sustainable development is the central organising principle of the Welsh Government.

Policies to promote sustainable development are set out under five chapter headings that mirror the headline indicators of sustainable development:

- sustainable resource use;
- sustaining the environment;
- a sustainable economy;
- a sustainable society;
- the wellbeing of Wales.

Proposed Indicators 2012

Economy	Society	Environment
Economic prosperity	Healthy life expectancy	Greenhouse gas emissions
Long term unemployment	Social Capital	Natural resource use
Poverty	Social mobility in adulthood	Wildlife & biodiversity
Knowledge & skills	Housing provision	Water availability

Proposed Supplementary Indicators 2012

Economy	Society	Environment
Population demographics – Total population	Avoidable mortality	UK CO ₂ emissions by sector
Population Demographics - Households	Obesity	Energy consumed in the UK from renewable sources
Debt	Lifestyles	Housing energy efficiency
Pension provision	Infant health	Waste
Physical infrastructure	Air quality	Land use & development
Climate change adaptation	Noise	Origins of food consumed in the UK
Research & development	Fuel poverty	River water quality
Environmental goods & services sector		Fish stocks
		Status of species & habitats
		UK Biodiversity impacts overseas

Further Discussion

You are part of a team who has been given the task of developing a set of indicators for promoting sustainable agriculture and rural development. Put forward a selection of key indicators justifying the reasons why they have been chosen.

Sustainable Development

Tutorial: Sustainable Development Indicators

1. Propose a group of characteristics that are likely to be present in any sustainable development indicator.
2. The UK Government have put forward a number of framework indicators which, according to some, do not go to the heart of the matter of what sustainable development is about. Sustainability is a complex issue, so can we really use simple SI's to measure it?

What did you think
of that then?

