

What is 'mass balance'?

The mass balance concept is based on the fundamental physical principle that matter can neither be created nor destroyed.

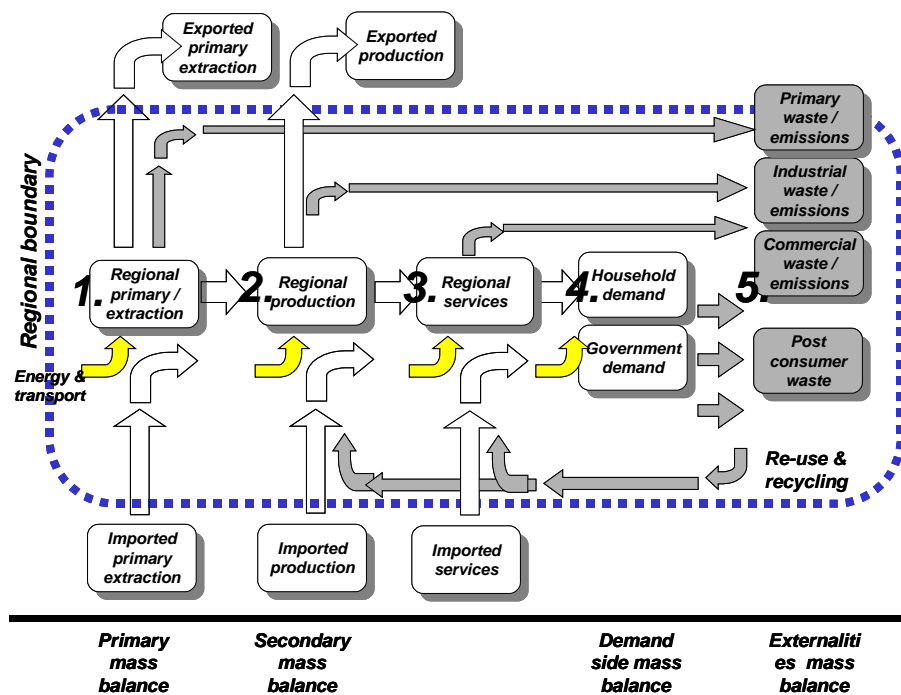
The mass of inputs to a process, industry or region balances the mass of outputs as products, emissions and wastes, plus any change in stocks. When applied in a systematic manner this simple concept of balancing resource use with outputs can provide a robust methodology for analysing resource flows.

The mass balance methodology also allows the development of "what if" scenarios where the impact of changes on resource flow can be measured. For example, what would be the impact on resource use if North West glass recycling levels increased to 50% of glass used by householders?

For more information on the Mass Balance concept and UK mass balance projects download the [UK Mass Balance Report](#) (Adobe acrobat PDF 343Kb, [PDF help](#)), produced by Forum for the Future. This report covers the mass balance methodology and includes a summary table of all the Biffaward funded mass balance projects.

MATERIAL FLOW & MASS BALANCE:

Concept framework for 5-stage model



The government's Performance & Innovation Unit has published a report entitled Resource productivity: making more with less, which looks at how the UK economy can be shifted onto a more sustainable footing and gives information on policy, next steps, actions and responsible government departments and measurement methods. The report also covers materials flow analysis methods, such as mass balance, and other means to measure our resource productivity, such as ecological footprints.

[Read the report](#)

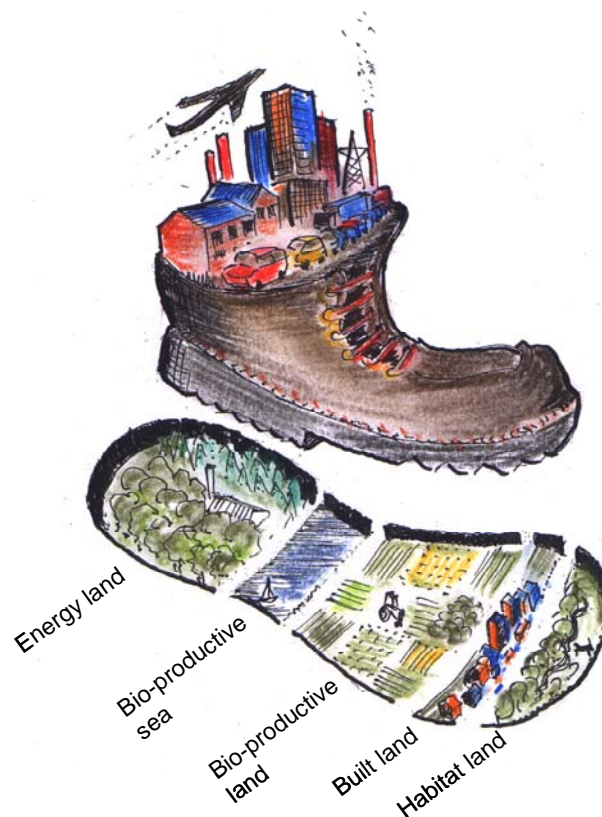
For more information on mass balance and the policy background as well as links to all the Biffaward funded UK mass balance projects go to www.massbalance.org

What is an ecological footprint?

An Ecological Footprint estimates a population's consumption of food, materials and energy in terms of the area of biologically productive land or sea required to produce those natural resources or, in the case of energy, to absorb the corresponding carbon dioxide emission generated, using existing technology. This land could be anywhere in the world. The ecological footprint is measured in "global hectares" ('gha')

- Ecological Footprints can be measured for a country, region, city, town or even at the level of an individual.
- The UK average ecological footprint is about 5 hectares/per person (1999 figures). This means that the average UK resident requires approximately 5 hectares of land to supply them with all their necessary resources, their transportation needs and the use and disposal of those resources.
- A sustainable ecological footprint, taking into account the protection of biodiversity, is approx 2 hectares per person. Sustainable scenarios suggesting how the North West could achieve this within key areas have been developed as part of the Eco-Region NW project. See [Eco-Region NW reports](#).
- [The World Wildlife Fund \(WWF\)](#) has done some interesting work on Ecological Footprints including comparing footprints of different nations/continents and the "Living Planet" report.

You can eco-footprint yourself at the earthday site based on your individual lifestyle (and which country you live in) and see how you would have to change your behaviour to match the earth's capacity to support you. You may get a shock - if everyone lived like the average US citizen we would need 8 earths to support us all. [Footprint yourself](#).



What is a material flow analysis?

The analysis of all material inputs and outputs to an area or activity, in this case the North West region of England. Your kitchen offers a good example of what we mean by materials flow. Every week one or two supermarket trolley loads come in, and three or four bin bags go out. We also need to include the fuel for the energy powering the fridge, cooker, microwave etc, and indeed the energy and materials involved in manufacturing them. And for the household as a whole, the same principle applies for other items such as furniture, carpets, lighting, toilet paper, garden equipment - and, highly significantly, the family car.

What is the difference between direct and total materials consumption?

Direct Materials Consumption (DMC) is the amount of materials directly used in the regional economy and consumed in the region, i.e. excluding exports.

Total Material Consumption is the total material use associated with regional consumption activities, including direct material consumption and the indirect or 'hidden' material flows involved in extracting, moving and processing the materials directly used. Again this excludes exports and their associated indirect flows.

What is a global hectare?

A global hectare (**"gha"**) is one hectare of biologically productive space with world-average productivity. In 2002 the biosphere had 11.4 billion hectares of biologically productive space corresponding to roughly one quarter of the planet's surface. This includes 2.0 billion hectares of ocean and 9.4 billion hectares of land. 1 global hectare is a hectare representing the average capacity of one of these 11.4 billion hectares.

Global hectares allow the meaningful comparison of the ecological footprints of different countries, which use different qualities and mixes of cropland, grazing land, and forest. For comparative purposes an ecological footprint is usually expressed in gha per capita (person).

Why do we look at consumption not production?

The Materials Flow and Ecological Footprint Analysis assesses material consumption and its impacts based on where the benefit is experienced. It includes imports of all kinds consumed in the region, anything produced and consumed in the region, and other activities that are of benefit to North West residents such as air travel. It excludes exports. As many industries and supply chains are increasingly global in scale, this is in many ways a more meaningful and comprehensive method of analysis.

What is the difference between real land and energy land?

Real land is actual land or sea area, sometimes called bioproductive land or sea, used to provide materials, food and other biomass. Energy land is forested land required for the absorption of carbon dioxide emissions from energy use. An ecological footprint is made up of both real land and energy land.

What is Factor Four?

Factor Four is a concept first used in the book of the same name published in 1997. It is based on the simple theme of doubling resource efficiency and halving resource usage. In other words, using one quarter of the energy and materials we currently consume. It offers a straightforward measure of what we would need to do to live on the planet more sustainably and equitably.

This Factor Four concept is now starting to inform national policy development, having been enshrined in the recent UK Energy White Paper. This sets out the long-term target of a 60% reduction in climate change emissions by 2050. While there is a difference between accounting for CO₂ (carbon dioxide) and ecological footprinting, they are very closely related. The Eco-Region NW project aims towards this 60% target, but on a global scale. Taking account of the disparities in

wealth and in emissions between developed and developing nations, and on the principle that the rich who are mainly responsible for the problem should be mainly responsible for solving it, we arrive at our overall target of Factor Four, or 75% reduction in ecological footprint by 2050, for the sustainable future scenarios.

What is global warming?

Average global temperatures have risen by about 0.60C over the past 100 years. A large part of this cannot be explained solely by our understanding of the natural variability of the climate system, and is believed to be caused by human activity, particularly the burning of fossil fuels and the resulting emissions of CO₂. The climate of the UK as a whole and of North West England has also changed over this period. By the 2080s, the average annual temperature in much of the North West could be up to 4.50C higher than the 1961-1990 average - with summer increases exceeding this. That is as large as the temperature rise from the last Ice Age to now. Climate change during this century will affect the social, economic and environmental well-being of the North West. We need to develop integrated responses to reduce the risks and seize the opportunities. For more information see the UK Climate Impacts Programme at www.ukcip.ac.uk

What is sustainable development?

Sustainable development requires that we live within the carrying capacity of the earth, allowing our economies to develop while ensuring that basic human needs such as food, clean water, shelter and warmth are provided for everyone, now and for future generations. It involves considering economic, social and environmental factors equally in any development decisions.

What is sustainable consumption or production?

The Government has in 2003 produced a strategy framework for Sustainable Production and Consumption (Full name: Changing Patterns - UK Government Framework for Sustainable Consumption and Production. It is available from the DTI website, www.dti.gov.uk). At its heart this framework involves a number of key principles:

- Ensuring that economic growth does not cause environmental degradation.
- Being more efficient in the use of natural resources, in particular increasing the productivity of material and energy use.
- Focusing policy on particular resources which have the most important environmental impacts, e.g. burning of fossil fuels causing CO₂ emissions.

Finding ways to make environmentally and socially sustainable consumption attractive to individuals and businesses.

How can we reduce our ecological footprint?

There are many practical ways to reduce the ecological footprint of the North West. Examples with particularly high potential include:

- Making food production more local and reducing energy intensive food processing;
- Increasing energy efficiency in buildings and electricity generation from renewables;
- Waste minimisation through more efficient use of resources and by increasing re-use and recycling.

In order to achieve significant reductions a co-ordinated strategic approach will be necessary. New forms of networks and partnerships will be needed to overcome the current fragmentation between sectors, departments and different levels of decision making.

How does Eco-Region NW relate to other mass balance projects?

See the Biffaward funded mass balance site for more information on this at www.massbalance.org. The UK Mass Balance Club brings together the 30 or so UK regional and industry mass balances being funded by Biffaward to build a picture of the UK as a whole. These projects are working together to pool data and ensure they are using the same methods, enabling regions and industries to be compared and contrasted consistently. This powerful project will enable a picture of the UK to be built from the bottom up rather than taking an overall generic view purely based on national high-level data, which would by its nature be less accurate.

How will Eco-Region be used?

Through the participation of the Steering Group (see [About Us](#)) it is planned that the results from Eco-Region NW will be used to inform North West policy for sustainable development in a number of key areas, including business support, spatial strategy, renewable energy, waste management and setting targets for improvement. Scenarios developed during the project will produce answers to "what if's" that can be used as an interactive tool to answer development questions in the future. Ideally, the results will be updated at regular intervals through the next 10-20 years to ascertain any improvement or worsening of the situation.

How do I get more information?

These sites will provide you with more information on current projects in the materials flow and ecological footprinting areas:

- www.york.ac.uk/inst/sei/
Stockholm Environmental Institute, York
Currently carrying out a number of Mass Balance and Ecological Footprinting studies in the UK including as the data collection and analysis lead partner for Eco-Region NW. SEI recently launched an ecological footprint study of York.
- www.biffaward.org/studies
Information on Biffaward's reasons for funding mass balance studies in the UK
Links to UK mass balance projects websites.
- www.massbalance.org
Information on the UK Mass balance study, linking all the local biffaward-funded projects and links to these projects. This also gives downloadable mass balance reports and policy background information on the use of mass balance studies.
- www.4sight.org.uk/second_page/
Site of the National Centre for Business and Sustainability and partners, which has sections on mass balance theory and the resource flow audit they are working on in Northwest England.
- www.citylimitslondon.com
Website of the London Mass Balance and Ecological Footprint study. This project launched results in September 2002. A downloadable version of the report is available here from this site.
- www.biffa.co.uk/publications/gbplc.html
Interesting background information on resource consumption in the UK in their UK plc report.