Chapter 2
One Planet Life

2.1 The increasing resource flow

Sustainable development is about how we – humanity – can live on the resources that our planet provides for us. Therefore the study and understanding of resource flow and resource use and management is the core of sustainability science. Our resource consumption has increased over the entire history of mankind, but the planet is the same, not any bigger. How can we as humanity adjust to the resources available to us?

The American historian John McNeill undertook to write a global environmental history for the 20th century. He started assuming that the environmentalists were exaggerating. Yes, there were environmental problems, but there has always been. "Nothing new under the sun" he told them when he started his project. But when he published he had changed his opinion and the title of the book became "Something new under the Sun". Not surprising! During the 20th century the human population had increased 4-fold, from about 1.5 billion to 6 billion. In addition, the economy per capita had also increased 4-fold. Thus the resource use on the planet had increased about 16-fold during 100 years. Obviously it cannot go on like that.

He examined a series of resources and the result was similar (Table 2.1): Global economy increased 14 times, industrial production 40 times, that is per capita income increased about 4 times. It is also noteworthy that energy use increased about as the economy, which is explained by the fact that economy is tightly coupled to energy for countries which are still developing. Emission are also tightly coupled to energy use since energy use is completely dominated by fossils and thus causes much of the emissions. Here carbon dioxide, CO_2, and SO_x is mentioned but it is also possible to mention NO_x or Hg, mercury. As people get a little richer they increase meat eating, reflected in the number of pigs, in this period about 2-fold, which is also a pressure on our environment and requires more resources. We can also see that the production from the environment is increasing and fields have expanded and forests shrink.

In Western Europe and the USA the strongest resource growth was after WWII, roughly between 1955 and 1975. During less than one generation re-

Table 2.1 Global Development 1900-2000. Source: John McNeill, Nothing new under the sun, 2001

global population	increased	4x
global economy	increased	14x
industrial production	increased	40x
energy use	increased	16x
carbon dioxide emissions	increased	17x
sulphur dioxide emissions	increased	13x
ocean fishing catches	increased	35x
number of pigs (=meat eating!)	increased	9x
forests	decreased	20%
agricultural fields	increased	2x
Blue whale	decreased to	0.25%

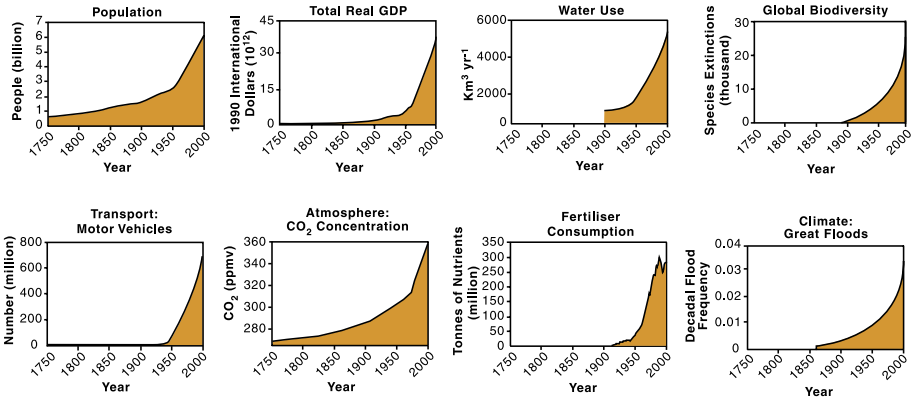

Figure 2.1 Exponential growth in a number of parameters illustrates the sharply increased use of resources. Source: International Geosphere-Biosphere Programme http://www.igbp.net/global-change/greatacceleration.4.1b8ae20512db692f2a680001630.html

source consumption increased almost 3-4 fold for very many products: metals, fertilisers, fossil fuels etc. During this period our societies went from fairly sustainable to affluent societies, affluent meaning with a large resource flow.

The change was much faster in the end of the century than in the beginning. In fact increase was most often measured in% of previous year! If this%age growth is constant we have exponential growth! This means constant doubling time. This gets very soon out of hand. Exponential growth may be illustrated by anything from the number of McDonald restaurants in the world to the consumption of paper.

It is also during this period that the landfills (garbage piles) of Europe increased tremendously! Around 1980 concern grew about what to do with the mountains of household waste. This was due to an increasing linear resource flow. The resources went from extraction to production, consumption and waste in a straight line! It is simply a recipe for resource wasting! To make this more sustainable we need to have cyclic resource flow. Recycling is an important part of sustainable development.

2.2 The large size of the resource flows and its consequences

The resource flow on our planet is very large. Material Flows Analyses, MFA, carried out in several countries in Western Europe show that flow of solid material is about 60-80 tonnes per capita and year. The figure is slightly smaller in e.g. Poland (about 50 tonnes) but much larger in the USA (about 80 tonnes). Materials in the largest amounts are bulk material (for building purposes), fossil fuel (energy purposes) and macro nutrients (mostly agriculture).

An estimate of the material flows on the planet as a whole (The Global Footprint Network, 2012) indicates that it is close to 50% more than the carrying capacity. This over-use of the resources corresponds to the use of fossil fuels, deforestation, over-fishing and so on. Resource use has increased during the entire history of mankind, but was far below the available resources up to about 100 years ago. During the 20th century resource use increased about 20 fold in many categories, for example, energy, and much more in some, for example, macro nutrients (McNeill, 2000). The carrying capacity of the planet was passed probably around 1980.

Material flows should decrease not only because resources are over-used but because resource flows as such lead to severe environmental problems. Most material flows in industrial countries are *linear*. The material flows directly, so to speak, from the sources to the waste heap. The material set in motion accumulates in the environment and cause problems. The most severe of these include:

- Global warming caused by fossil fuel combustion which leads to accumulation of carbon dioxide in the atmosphere.
- Eutrophication due to accumulation of nitrogen and phosphorous from agriculture in water bodies.
- Acidification of forests and lakes due emission of sulphur oxides from combustion of fossil fuels.
- Toxic effects of metals accumulating in the environment, e.g. mercury and lead.
- Toxic effects of man-made substances accumulating in the environment, such as PCB.

As a rule the flow of non-renewable resources causes environmental problems long before they are depleted at the source. The environment is not able to handle large amounts of a substance that is not part of the normal set-up. As the resource flow continues, it leads to an accumulation of the substance, and sooner or later it will become detrimental to the environment. The large anthropogenic material flows of resources are not similar to the natural flows. Ecosystems, as a rule, recycle resources and all material are used for new purposes.

The carbon cycle has a special role in this resource flow. The carbon of the planet is found in the atmosphere as carbon dioxide, dissolved in ocean water, bound in biomass, and stored in the lithosphere as carbonate minerals. Although the atmosphere holds only 0.036% of CO_2 this substance is a key component in the physics of the planet since it interacts, as explained, with the heat balance. It is also essential to all living cells as it is used when new biomass is built up in carbon dioxide fixation.

Carbon dioxide fixation removes carbon from the atmosphere and respiration returns it back. In respiration organic molecules are oxidised with oxygen to provide energy to living cells. The by-products are water and carbon dioxide.

All kinds of combustion and decay processes add to this flow. Today, the comparatively immense utilisation of fossil fuels seriously disturbs the balance between natural processes. Modern combustion practices cause the concentration of carbon dioxide to increase. This increase is the key factor behind the enhanced greenhouse effect. The people of the Earth now consume 6 gigatonnes carbon/year, a mass that exceeds the mass of all the metals used by mankind during the period of time by a factor of ten! In addition, the handling of many fossil fuels involves flows of other matter than pure carbon, particularly sulphur (see below), which adds to the turnover of matter and many profound environmental stresses.

2.3 The Limits to Growth

The society has to operate within the boundaries of a global ecosystem which has – very definitely – a *finite capacity* to supply resources and to absorb the discharges. The same argument holds for the full variety of services that are offered by the ecosphere in providing clean air, good quality and quantity of water, clean and usable top soil and sustainable conditions for agricultural and industrial production, transportation and living. The sustainability scenario also has to affect the economical and the administrative systems which should be considered as subsets of the total natural system in which humanity dwells together with other species.

It is important that the natural resources utilized for the society are restricted to magnitudes that do not over-burden the environment. "Ecology worries about resource flows, since these are what contribute to environmental impacts" (Spangenberg et al, 1997). It is conceivable that the natural systems can pass a critical point where they will break down and fail to support what they have supported in the past. The world population is growing and the total physical activities of that population is growing even more.

In 1972 a research team at the Massachusetts Institute of Technology (MIT) on commission of the Club of Rome published the ground breaking study *Limits to Growth*. It is a study of global resource flows. They found that the resource flows increased exponentially and that very soon the world would reach a state of *overshoot*, that is, a state where it would use more resources than the planet could produce.

When *The Limits to Growth* was published in 1972, economists, along with many industrialists, politicians, and Third World advocates raised their voices in outrage at the suggestion that population growth and material consumption need to be reduced by deliberate means. But nothing that has happened in the last 40 years has invalidated the book's warnings. It was not until the early 2000 that economists (see e.g. Wall Street Journal) accepted the fact that there are limits to (physical) growth.

The world can respond in three ways to signals that resource use and pollution emissions have gone beyond their sustainable limits. One way is to disguise, deny, or confuse the signals. Generally this takes the form of efforts to shift costs to those who are far away in space and time. An example would be to buy air conditioners for relief from a warming climate, or to ship toxic wastes for disposal in a distant region.

A second way is to alleviate the pressures from limits by employing technical or economic fixes. For example, reducing the amount of pollution generated per mile of driving or per kilowatt of electricity generated. These approaches, however, will not eliminate the *causes* of these pressures.

The third way is to work on the underlying causes, to recognize that the socioeconomic system has overshot its limits, is headed toward collapse, and therefore seek to change the structure of the system. A computer model of the world resource flow can be used to test some of the simplest changes that might result from a society that decides to back down from overshoot and pursue goals more satisfying and sustainable than perpetual material growth.

There are many thoughts about what steps towards a more sustainable society would look like. *Some people think that a sustainable society would have to stop*

using nonrenewable resources. But that is an over-rigid interpretation of what it means to be sustainable. Certainly a sustainable society would use nonrenewable gifts from the earth's crust more thoughtfully and efficiently.

The authors to the Limits to Growth suggest a few general guidelines for what sustainability would look like, and what steps we should take to get there:

- Extend the planning horizon. Base the choice among current options much more on their long-term costs and benefits. Today we suffer from "short-termism". Companies think about their near future, even the coming months, and politicians about the next election. But that is too short a time frame when discussion the limits to growth.
- Improve the signals. Learn more about the real welfare of human population and the real impact on the world ecosystem of human activity.
- Speed up response time. Look actively for signals that indicate when the environment or society is stressed. Decide in advance what to do if problems appear.
- Minimize the use of nonrenewable resources.
- Prevent the erosion of renewable resources.
- Use all resources with maximum efficiency.
- Slow and eventually stop exponential growth of population and physical capital.

The Limits to Growth team continues: *The necessity of taking the industrial world to its next stage of evolution is not a disaster – it is an amazing opportunity.* How to seize the opportunity, how to bring into being a world that is not only sustainable, functional, and equitable but also deeply desirable is a question of leadership and ethics and vision and courage, properties not of computer models but of the human heart and soul.

Sustainability does not mean zero growth. Rather, a sustainable society would be interested in qualitative development, not physical expansion. It would use material growth as a considered tool, not a perpetual mandate. Neither for nor against growth it would begin to discriminate among kinds of growth and purposes for growth. It would ask what the growth is for, and who would benefit, and what it would cost, and how long it would last, and whether the growth could be accommodated by the sources and sinks of the earth.

The question of how to create a sustainable future is the most urgent to find answers to for anyone who has been confronted with the results of the Limits to Growth studies. This is discussed at some length in the movie "The Last Call" released in 2013 by the Italian producer Enrico Cerasuolo (http://www.lastcallthefilm.org/). Here the researchers of the Limits to Growth study give their points of view.

2.4 Overshoot

Today humanity uses the equivalent of 1.5 planets to provide the resources we use and absorb our waste. This means it now takes the Earth one year and six months to regenerate what we use in a year. Moderate UN scenarios suggest that if current population and consumption trends continue, by the 2030s, we will need the equivalent of two Earths to support us. And of course, we only have one. Turning resources into waste faster than waste can be turned back into resources puts us in global ecological overshoot, depleting the very resources on which human life and biodiversity depend.

The result is collapsing fisheries, diminishing forest cover, depletion of fresh water systems, and the build-up of carbon dioxide emissions, which creates problems like global climate change. These are just a few of the most noticeable effects of overshoot.

Overshoot also contributes to resource conflicts and wars, mass migrations, famine, disease and other human tragedies – and tends to have a disproportionate impact on the poor, who cannot buy their way out of the problem by getting resources from somewhere else.

Global trends, however, hide the huge variability that exists at the regional level. Europe and Middle East/Central Asia experienced the largest increase in their per capita Ecological Footprint (+1.2 and +1.1 gha per person, respectively), but while Europe's population growth was relatively slow (+29%), population grew 330% in Middle East/Central Asia. North America had a smaller increase in

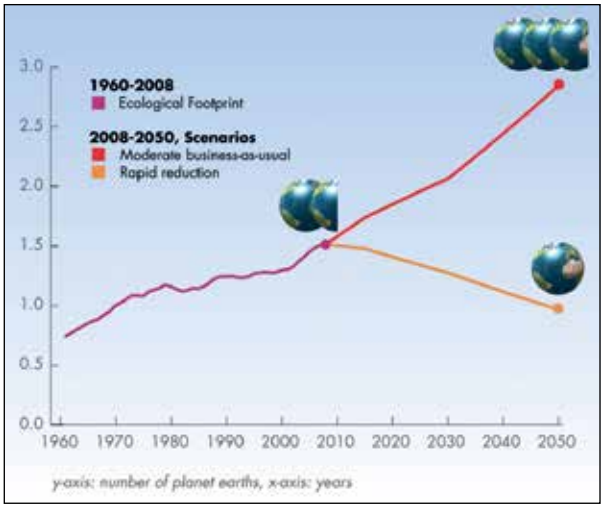

Figure 2.2 The World's Ecological Footprint. Today humanity uses the equivalent of 1.5 planets to provide the resources we use and absorb our waste. This means it now takes the Earth one year and six months to regenerate what we use in a year. Moderate UN scenarios suggest that if current population and consumption trends continue, by the 2030s, we will need the equivalent of two Earths to support us. (Source: www.footoprintnetwork.org)

per capita consumption (+ 0.6 gha per person) and a 63% growth in population. At the other end of the spectrum, Africa saw its per capita Ecological Footprint decline (-0.1 gha per person), while its population increased by 255%. In the Asia-Pacific region, per capita Ecological Footprint increased slightly (+0.6 gha per person), while population grew by 136% (Figure 2.3).

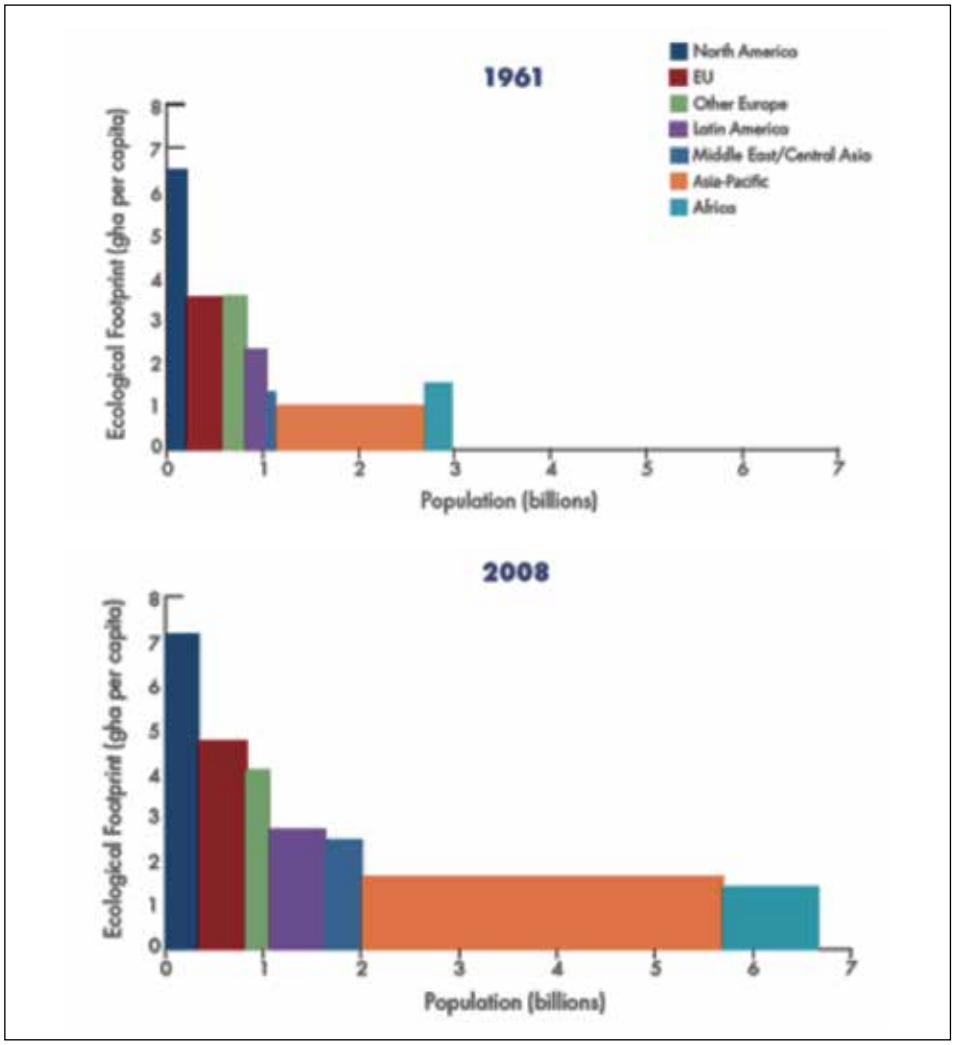

Figure 2.3 Ecological Footprint and population by world's regions in 1961 and 2008.The area within each bar represents the total Ecological Footprint for each region. (Source: www.footoprintnetwork.org)

Figure 2.4 tracks the per-person resource demand Ecological Footprint and biocapacity in Uzbekistan since 1961. It shows that Uzbekistan has an overshoot, and use about 2 planets. (Source www.footoprintnetwork.org)

The total Ecological Footprint of a country is a function of the average consumption pattern of each individual, the efficiency in production and resource transformation, and the number of individuals in the country. Biocapacity is determined by the available biologically productive land and sea areas and the capacity of these assets to produce resources and services useful for humans (this is determined by the prevailing technology and management practices implemented in these areas).

2.5 Resource flows and human wellbeing

The transition to a sustainable society requires that we live a *one-planet-life.* We need to reduce our consumption of resources to those available in the long term, to the carrying capacity of the planet. This will certainly include a number of technical adjustments, such as houses needing less heating, and cars not running on fossil fuels. But it will also require changes in lifestyles. An example is the Swedish family, which experimentally got all the technical devices in a new house (low energy house with solar panel for hot water and PV cells) to live a low carbon life. When it was time for ski vacation the air trip to the Alps was not allowed within the carbon budget. They had to take the train to the Swedish mountains. Not necessarily worse, but a change. Nor was it possible to use the private car for commuting to work, but rather public transport and biking, and they had fewer dinners with steaks, and had to be more careful with waste sorting. Still their carbon foot print was more than 1 tonne per year and capita.

Basic human needs have been much researched. The model proposed by American psychologist Abraham Maslow already in the 1940s includes five levels of needs: first physiological needs, such as food, water and air; next the individual's safety and security such as personal security, financial security, health and

well-being; thirdly social needs including feelings of belongingness, friendship, intimacy, and family; fourth, the need to be respected and to have self-esteem and self-respect; and finally self-actualization: "What a man can be, he must be". Viktor Frankl, with experience from the holocaust, later added self-transcendence, spiritual needs. Chilean philosopher Manfred Max-Neef, as well as others, have later criticized the level structure and argued that fundamental human needs are non-hierarchical.

From a sustainability perspective it is relevant to observe that none of these needs refer to having many things, consumerism, or travelling over the world, or other parts of modern life which consumes many resources. Also in research on energy use it is clear that what people appreciate the most consumes least energy. Thus being with friends and family or the loved one does not cost much energy, while daily commuting to work, which takes much energy, is not popular. The world's carrying capacity may then be enough for all of us. Mahatma Gandhi in a famous statement once said: "The world has enough for everyone's need, but not enough for one person's greed", when talking on a society based on Sarvodaya – the well-being of all.

The recently developed happiness research stresses that numerous studies have clearly shown that subjective well-being and material wealth are only loosely coupled. *Perceived well-being* in western industrialised countries peaked around 1970 or so, while economic development and resource use has continued to increase without resulting in any increase in perceived well-being. Immaterial factors which contribute to quality of life – such as leisure, having meaning and purpose, relationships, social participation and self-fulfilment – become more and more important.

There are several indices to monitor human wellbeing. Most established might be the United Nations Human Development Index, HDI, which includes the three indicators child survival, purchasing power and education. Values of HDI are available for most countries in the world. A sustainable society is seen as a society where human well-being is high enough (HDI > 0.8) and ecological footprint low enough (<.1.8 global ha/cap) (See www.footoprintnetwork.org). Other more developed indices include the Weighted Index of Social Progress, WISP, by Richard Estes to measure the amount of well-being in different societies, which uses up to 40 different indicators.

To measure of the development of a country most countries use the Gross Domestic Product GDP, which is the total economic turnover, but several alternatives have been proposed. The Genuine Progress Indicator, GPI measures whether a country's growth, increased production of goods, and expanding services have

Figure 2.5 UN Human Development Index 2011, quartiles; dark blue = very high, white=low. (Source Wikipedia: Human Development Index)

actually resulted in the improvement of the well-being of the people. In GPI negative costs, such as costs for environmental impacts, are subtracted from GDP. The Gross National Happiness, GNH, proposed in Bhutan already in the 1970s based on Buddhist ideals suggests that beneficial development of human society takes place when material and spiritual development occur side by side to complement and reinforce each other. The four pillars of GNH are the promotion of sustainable development, preservation and promotion of cultural values, conservation of the natural environment, and establishment of good governance. Both GNH and GPI are based on the assumption that subjective measures like well-being are more relevant and important than more objective measures like consumption.

2.6 Practical steps towards a one planet life

There are a number of organisations of civil society which have contributed to the efforts to reduce resource consumption and improve sustainability by explaining how to do it. Best known may be the World Wildlife Fund, WWF. WWF has produced a guidebook and also a calculator which allows you to estimate the footprint you cause by your lifestyle. They write:

"If we carry on living the way we are, pretty soon we are going to need to find a second planet to meet humanity's growing demand for energy and natural resources. According to WWF's Living Planet Report we are increasing consumption of resources and the amount of wastes (including carbon emissions) we produce so fast we may need that second planet in less than 30 years.

Figure 2.7 The WWF Pocket Guide to a One Planet Lifestyle. (http://d2ouvy59p0dg6k.cloudfront.net/downloads/opl_ebooklet.pdf)

But we don't have a second planet yet where we can harvest new resources from or dump our wastes on. And even if we had one, would it be ethical to do it? The fact is: we only have one precious and beautiful planet. What we need to do now is learn how to live on this single planet sustainably.

There are small steps we can all take that help make a big difference. And you will find them right here in WWF's Pocket Guide to a One Planet Lifestyle. In this e-book you'll find handy tips on how to slash your carbon footprint while saving money by reducing your cost of living.

You can also access new WWF tools to help you calculate your personal footprint, measure the positive effects of your lifestyle changes, find low-carbon alternatives to travel, and get help on how to find energy-efficient appliances or a green electricity supplier."

WWF has published the WWF *Pocket Guide to a One Planet Lifestyle***.** Here they say: "Wouldn't it be great if we could all live in a way that was more environmentally-friendly and which, at the same time, was cheaper, give us more time to spend with friends and family and meant we were healthier? WWF has researched a set of 'Ten Top Tips' with suggestion about small changes we can make to the way we live, work and play which could help make big difference to our planet – and to the quality of our lives.

In the pocket books there are hundreds of small actions each one can do to reduce his or her footprint. There are also indications how one can work in a municipality or in a company.

The UK based organisation *Bioregional* works for the same goals in a slightly different way. They write (http://www.bioregional.com/about-us/):

"Bioregional champions a better, more sustainable way to live. We work with partners to create better places for people to live, work and do business. We want to see thriving regional economies where we meet more of our needs from local, renewable and waste resources, enabling people to live happy, healthy lives within the natural limits of the planet, leaving space for wildlife and wilderness.

Box 2.1 The ten principles of one planet living according to Bioregional

Health and happiness – Encouraging active, sociable, meaningful lives to promote good health and well being

Equity and local economy – Creating bioregional economies that support equity and diverse local employment and international fair trade

Culture and community – Respecting and reviving local identity, wisdom and culture; encouraging the involvement of people in shaping their community and creating a new culture of sustainability

Land use and wildlife – Protecting and restoring biodiversity and creating new natural habitats through good land use and integration into the built environment

Sustainable water – Using water efficiently in buildings, farming and manufacturing. Designing to avoid local issues such as flooding, drought and water course pollution

Local and sustainable food – Supporting sustainable and humane farming, promoting access to healthy, low impact, local, seasonal and organic diets and reducing food waste

Sustainable materials – Using sustainable and healthy products, such as those with low embodied energy, sourced locally, made from renewable or waste resources

Sustainable transport – Reducing the need to travel, and encouraging low and zero carbon modes of transport to reduce emissions

Zero waste – Reducing waste, reusing where possible, and ultimately sending zero waste to landfill

Zero carbon – Making buildings energy efficient and delivering all energy with renewable technologies

We call this *One Planet Living*. Calculate your impact and get a personal action plan with the One Planet Living footprint calculator

The concept of One Planet Living builds on sustainability work carried out over the past few decades but specifically grew out of Bioregional's work to build the BedZED eco-village in south London. Living and working at BedZED and analysing its impacts drew us clearly to the conclusion that to achieve sustainability, we need to make it easy, attractive and affordable for people everywhere to lead whole sustainable lifestyles – not just green buildings, but wider infrastructure and products and services as well – all wrapped up in a simple and clear story which people can understand.

Since its creation in 2003, One Planet Living and its ten principles show in practice that a simple way for us to plan, deliver, communicate sustainable development and a green, circular economy is possible.

Rooted in the science and metrics of ecological and carbon footprinting, 10 One Planet principles are used to structure thinking and inform holistic action. These principles stemmed from Bioregional's experience of working on BedZED, a pioneering eco-village in South London, UK. Together, the principles provide a holistic framework to help organisations and project teams examine the sustainability challenges faced, develop appropriate solutions and communicate the actions being taken to key stakeholders such as colleagues, the supply chain, clients, customers and local and national government."

Chapter 2 sources:

Sections 2.1-2.4. Lars Rydén and Natalya Akinshina (editors). Uzwater book Sustainable Use and Management of Natural Resources (http://www.balticuniv.uu.se/index.php).

Section 2.5 Lars Rydén: Baltic University Sustainable Development course 8c. Social sustainability, happiness and the one-planet-life. (http://www.balticuniv.uu.se/index.php/introduction)

Section 2.6 WWF Pocket Guide to a One Planet Lifestyle (http://d2ouvy59p0dg6k.cloudfront.net/downloads/opl_ebooklet.pdf) and Bioregional One Planet Living (http://www.bioregional.com/about-us/).