The road to global sustainability

Urgent need to reduce material consumption and the human population

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The problems of growth

All around us we see the problems of growth: too high CO2 emissions causing climate change, an increasing shortage of raw materials and fossil fuels. Moreover, there are fewer and fewer fish in the oceans and we are running out of arable land, fresh water and living space. Loss of biodiversity and economic instability are the result.

All these problems are caused by over-consumption. This document discusses the role of the human species in the ecosystem Earth. We will suggest an ecological framework within which we should organize our society in order to give the next generations the chance to have an adequate standard of living.

The basic solution to all the problems is to reduce the global consumption to a level below the carrying capacity of the Earth. Limiting consumption per person and decreasing the world population are both needed to achieve this. Often too much is expected from technology. We will argue that technology can only play a limited role in solving current environmental problems.

Therefore, this document considers the necessity of reducing material consumption and the global population. Only then can we solve the problems of growth that are affecting our species and all other animals and plants populating the Earth.

The unequal distribution of wealth and power are becoming increasingly evident; there is more and more tension arising from disputes over land ownership and access to increasingly scarce natural resources. However, we will not be dealing with the distressing differences between poor and rich in this document. Not because they are unimportant, but because first and foremost we wish to establish the limits the environment imposes on us and then get people to respect them. Solutions for social problems should be looked for within these limits. See e.g. Tim Jackson, literature 1, appendix 8.

The mantra of the three Ps

The three Ps stand for **Planet**, **People** and **Profit**. It is often argued that to achieve a sustainable world, the three Ps should be in harmony. A use of words that always sounds convincing.

But not everyone puts the three Ps in the same order. Businesses usually put Profit first, so for them the order is Profit, People, Planet. Sociologists will most likely put People first.

We argue that **the three Ps cannot be equal**. The Planet can easily survive without People, but People cannot survive without a healthy Planet. And without People there is no Profit.

Our prime concern is that human society continues to exist. This depends on us using the environment in a sustainable way, in other words **Planet First!** (literature 3). We therefore need to assess whether the Earth can sustainably supply the resources needed for our economic activities.

Overshoot

Overshoot means using more than is available. Calculations show that humanity takes more from the Earth than the Earth can produce sustainably.

Already in 2007, an overshoot of 50% was measured by the Ecological Footprint model. Putting it in another way, in one year humanity used what the Earth could only produce in one and a half years. The overshoot is increasing year by year (see literature 2).

The overshoot is having a dramatic effect on biodiversity: the Living Planet Index shows a dramatic decline of populations of wild animal species in a variety of ecosystems, 30% in forty years (see literature 2).

The analysis of the Planetary Boundaries shows that we are approaching the limits in several crucial areas, and in some cases have already crossed them, see appendix 6. Most dramatic are biodiversity loss, climate change, diminishing supplies of fresh water, nitrogen and phosphorus, needed for food production.

In this document we use the model of the Ecological Footprint, because it is an integral indicator. It takes into account as many environmental factors as possible. In this sense, it is the most complete model we know.

Biocapacity

The biocapacity is the total of what the Earth can sustainably produce. Thus, the biocapacity determines how many people can live on the Earth, their number depending on their level of resource use.

The productivity of a hectare of land depends on many environmental factors, among which are the fertility of the soil, the climate and the availability of water. In countries in arid areas or close to the polar regions, the bioproductivity is naturally much lower than in fertile areas with a favourable climate: a much larger area is needed to produce the same amount of biomass. Therefore, people living in a less favourable environment need more land per person to reach the same standard of living. For our Footprint model, it is necessary to account for these differences in productivity per hectare. Therefore, **biocapacity is expressed in global hectares (gha)**. A global hectare is a hectare multiplied by a yield factor. Yield factors are calculated per year and per land type for each country. The land types are cropland, pasture, fishing grounds, forests and built-up land.

However, the yield factors are not only influenced by natural factors, but also by the use of fertilizers and pesticides and by plant breeding. So the yield factors as used in the model are higher than they would be in natural sustainable conditions.

For example: the Netherlands have an average yield factor of about 5, each hectare producing five times as much as the global average. This means that in the Footprint model one hectare of land in the Netherlands equals five global hectares. This is partly due to its favourable position in a fertile river delta with a mild climate, but also to the large-scale application of advanced agricultural techniques.

Data for 2008 from the Living Planet Report 2012 showed that worldwide 1.8 global hectares (gha) of biocapacity was available per person.

The Footprint model

The Footprint model is also known as the Ecological Footprint or Global Footprint model. The footprint indicates how many hectares humanity consumes by producing goods, distributing them, using them and disposing of the resulting waste. An increasing part of our footprint is taken by all the public services needed for organising our complex society. The **footprint is also expressed in global hectares** (gha) and thus can be compared with the available biocapacity. Therefore, t**he Footprint model is an indicator of sustainability**.

However, the Footprint model still underestimates the true environmental impact of our consumption. Fossil fuels are accounted for, although in an indirect way, by calculating the virtual area of forests needed to absorb the CO_2 emissions. Other non-renewable resources, such as rare earth metals and uranium, are not included in the model. A separate model, the Water Footprint, measures the impact of our consumption of fresh water, both for drinking and for use in agriculture and industry.

Although an approximation, the Footprint model provides a useful estimate of our consumption. The entities for which the footprint can be calculated range from individuals and families via villages, towns and cities to whole countries, or a combination of countries, such as the European Union (EU).

The footprint of a country is the product of the population number and the average footprint per person:

total footprint = population x average footprint per person.

For the whole world:

global footprint = world population x average footprint per person.

Moreover, the environmental impact of a variety of human activities, such as production methods, ways of transport, or those belonging to certain life styles, can also be expressed in terms of footprint. Thus, each product has its footprint.

Space for nature

The living space on Earth is crucial for all species inhabiting the planet, not only humans. The various ecosystems need space to exist. Lack of it can lead to loss of biodiversity. Damage to ecosystems, qualitative or quantitative, leads to their decline or even their collapse, developments disastrous for mankind and for nature in all its richness and diversity. No one species should claim all space for its own ends.

In 1987, the Brundtland report *Our Common Future* recommended reserving only 12% of the land surface for nature, claiming 88% of the space on Earth for humanity. The 50% suggested by biologist Edward Wilson is surely a better target.

Yet, in 2007 only 12.9% of the Earth's land surface, including non bioproductive land, was protected as nature reserve (Living Planet Report 2010). In 2010, in Nagoya, the United Nations (UN) accepted a proposal to reserve 17% of land area for the conservation of biodiversity.

In this document, we reserve 15% of our bioproductive land for nature, basing this on the Living Planet Report 2010. We regard this percentage as the bare minimum for preserving biodiversity.

Overpopulation and overconsumption

At present, the global footprint is greater than the available biocapacity. We are living in a state of overshoot, and have been doing so since about 1970 both because of a growing world population and of a growing average footprint per person.

In the West, we are barely aware of this global overshoot, because of a modern form of colonialism: we compensate for our lack of biocapacity by importing foodstuffs from poorer countries and also by outsourcing work and production.

This is unacceptable, because most of the poorer countries need their biocapacity for themselves. Poor countries in a state of overshoot, including developing economies such as China and India, are heading towards ecological catastrophes.

To further analyse this state of overshoot, we take into account the data of each country or group of countries, using population number and average footprint per person as indicators.

Footprint, population size and biocapacity

The following table shows by how much the population and/or the average footprint need to be reduced to eliminate the overshoot in a number of countries, the European Union, Africa and the world. Our calculations are based on data from www.footprintnetwork.org. We allow **15% room for nature**, and assume that the elimination of overshoot **will be realised by each country,** see p. 7 and appendix 5.

From left to right, the columns represent:

- Country or group of countries in descending order of overshoot. The Earth has been added for comparison.
- Overshoot, that is the percentage with which the footprint exceeds the available biocapacity. For example, when 15% is reserved for nature, the total footprint in the Netherlands is 7.09 times the available biocapacity. This is equal to an overshoot of 609%.
- Population size in millions.
- Footprint per person in gha (global hectares).
- Biocapacity available for mankind per person. These figures also indicate how much the footprint per person would have to decrease in order to reach sustainability, if the size of the population remains the same.
- Maximum population with which it is possible to reach sustainability, if the footprint per person remains the same.

– Maximum population and maximum footprint per person; these last two columns should be read together. We assume an equal contribution in achieving sustainability.

The countries that are not using all their biocapacity at the moment, such as Russia and Brazil, are extremely important for the preservation of natural areas and thus, of biodiversity. Other countries should realise that by importing raw materials, they are using the biocapacity of these countries and therefore may threaten these natural areas.

data 2007						15% reserved for nature	
country/region/Earth	Overshoot	population (million)	footprint per person (gha)	available biocapacity per person (gha)	maximum population with current footprint (million)	with equal share: maximum population(million)	with equal share: maximum footprint per person (gha)
Netherlands	609%	16.5	6.2	0.9	2.3	6.2	2.3
Belgium	601%	10.5	8.0	1.1	1.5	4.0	3.0
Egypt	216%	80	1.7	0.5	25	45	0.9
Germany	211%	82	5.1	1.6	27	47	2.9
China	166%	1337	2.2	0.8	502	819	1.4
EU	164%	492	5.0	1.9	186	303	3.1
USA	143%	309	8.0	3.3	127	198	5.1
India	110%	1165	0.9	0.4	553	803	0.6
France	96%	62	5.0	2.6	31	44	3.6
Earth	78%	6671	2.7	1.5	3748	5000	2.0
Ghana	73%	23	1.8	1.0	13	17	1.3
Africa	12%	960	1.4	1.2	857	907	1.3
Russia	-10%	142	4.4	4.9	157	149	4.6
Brazil	-62%	190	2.9	7.6	500	308	4.7

From the table, we conclude that the EU has various options for attaining sustainability:

- reduce the population from 492 to 186 million;
- reduce the footprint per person from 5 to 1.9 gha;
- simultaneously reduce the population to 303 million and the footprint per person to 3.1 gha.

For the Netherlands:

- reduce the population from 16.5 to 2.3 million;
- reduce the footprint per person from 6.2 to 0.9 gha;
- simultaneously reduce the population to 6.2 million and the footprint per person to 2.3 gha.

Of course, it is also possible to choose a different proportion than fifty-fifty; the goal remains returning to a sustainable situation, in which we do not use more of our resources than are available nationally. Ideally, this problem should be tackled globally, but as long as the UN has no effective policy concerning it, individual countries should take their own responsibility and start to act.

Technology and recycling

Many people express confidence in the ability of technology to ultimately solve all environmental problems. Technology has indeed achieved much in various fields, among them public health, communication and transport. However, almost all of these achievements have also caused new environmental problems, as we will illustrate with a few examples.

- Engines of cars have become more fuel efficient, but at the same time, the cars are heavier and the engines more powerful. More cars are being used, and each car is travelling more kilometres. So, despite the technical improvements, more petrol is used and thus the environmental stress due to cars has grown.
- Electric cars use less energy compared to those driven by petrol, but the availability of the resources needed for the batteries is limited.
- Acid rain is nearly a thing of the past; the technology needed to achieve this, however, resulted in a higher emission of carbon dioxide.
- LED-lamps use less electricity than normal light bulbs. But, because they are considered more environmentally friendly, more of them are used and often left on longer. Moreover, their disposal also presents an environmental problem.
- Many products that use less energy have often required much energy for their development and production. Many of them contain rare minerals, such as lithium and rare earth metals, that require a lot of energy to extract.

Moreover, recycling, including cradle-to-cradle, requires energy, space, time and other resources. Thus, recycling also stresses the environment.

As resources become increasingly scarce, technological solutions are becoming increasingly difficult to find. We welcome technological innovations that will give us a smaller footprint, but the whole life cycle of a new product needs to be measured. Unfortunately, often the new technology demands even more of the environment, meaning a bigger footprint, leaving the bill for future generations. Unconditional trust in technology and recycling is therefore unfounded.

Discussion points

The way forward to global sustainability is only possible with the reduction of both population numbers and the footprint per person. Their respective share in achieving this aim can vary, but both factors need to be considered. In the rest of the report we discuss:

- the necessity of a national or supranational approach;
- a quota system to limit consumption, in order to fit with what the Earth can sustainably supply;
- ways of reducing population numbers, both in our own country and in developing countries;
- how to adapt the economy to a quota system.

We think that these measures can provide an effective and adequate solution for our ecological problem and not just alleviate the symptoms.

National, supranational or global approach

The problems we mention above are all global. In order not to ask more of the Earth than it can give, the global population will have to shrink, either to less than 4 billion people if we wish to maintain the current standard of living, or the average footprint per person has to decrease from 2.7 to 1.5 gha when the global population stays the same size. A choice can be made between these two options, for example by decreasing the global population to 5 billion and reducing the footprint per person to 2 gha. Whatever is chosen, our consumption should not exceed the biocapacity of the Earth.

Although every inhabitant of the world should have an equal share of the global biocapacity (*Fair Earth Share*), in reality this is not the case. Rich countries, mostly Western but also for example China, achieve much of their current prosperity by importing goods from other, mostly poorer, countries or using land abroad to grow their crops. As a consequence, the poor countries have little biocapacity left for their own needs. Meanwhile, we are putting their remaining resources under more and more strain.

Ideally this problem should be tackled globally, but in practice this is not possible. Therefore, for reasons as set out in appendix 5, each country, or perhaps a group of countries, e.g. the European Union (EU), should ensure that its footprint is within the available biocapacity. The figures in the table above are based on this national approach. For example, to achieve this, the Netherlands or the EU will have to **reduce both the** f**ootprint per person and the population size**.

Lowering living standards is not an option for most people in developing countries. Therefore, stopping population growth and afterwards reducing the numbers seems to be the only way to stop exceeding their biocapacity. Furthermore, rich countries will have to stop using the biocapacity of developing countries, leaving it to be used by the people who live in them.

Only a limited amount of influence can be exerted by one culture on another. It is better to start nearer home by reducing the footprint in our own country, until it falls within our own biocapacity. In this way, we take our own responsibility.

Global trade of course will remain possible, but we envisage this on a smaller scale and in the form of an exchange of products produced with the locally available biocapacity.

Implementing quota

Several possibilities for reducing ones personal footprint can be found in appendix 1. Quite a few people do this voluntarily, such as by riding a bike, travelling by public transport, not

travelling by plane, and by eating less meat and fewer dairy products. However, the problem of overshoot is so urgent that voluntary action by individuals is not enough: each government should take measures to ensure that the country's footprint is within the limit of its biocapacity. See appendix 2.

We see three different ways in which a government can take action: legislation, taxes and quota.

- **Legislation** can be effective in banning the use of certain products and enforcing the use of others, but in practice regulations may make life too complicated. Moreover, it limits freedom of choice.
- **Taxes** should be discussed, but they usually only have a limited effect. Taxes on tobacco, petrol and alcohol have not permanently lowered consumption, and the tax on packaging has had no lasting effect on its reduction.
- Introducing a **quota system** puts a limit on the use of rare materials and resources, and divides them fairly among the population. It is a socially just measure, which therefore should get wide support among the population. People are free to choose which goods to buy, as long as they do not exceed the boundaries of their quota.

Consequently, we think that **implementing certain quot**a is the most effective and fair solution. We propose first putting a quota on meat, fish and dairy products. The next step would be a quota on carbon dioxide emissions to limit fossil fuel consumption. Later, the total consumption of an individual, expressed as footprint, can be limited; the footprint becomes the unit of the quota. For a survey of existing proposal for quota systems in Europe, see appendix 4.

Population decrease

Recently, the United Nations released new figures about the global population: the medium fertility scenario shows that in 2100 there will be nearly 11 billion people on Earth. The inevitable demand for more materials will increase the overshoot. A rather grim picture of the future emerges. Population reduction should be added to the political agenda without delay.

In many western countries, the population will decrease as the number of children born is less than needed to keep it stable. This is about to happen in the Netherlands: the decrease that has started slowly in some parts of the Netherlands should be seen as the beginning of a desirable development and not as a threat to our economy. See appendix 3.

In contrast, stopping the population growth in developing countries is not that simple. Many studies suggest that education and special health care for women and an increase in socio-economic security will lead to women choosing to have fewer children. However, in the hopeless situation in which many people live, such goals are unattainable and will remain so, as long as the population keeps growing. It is a vicious circle.

Research also shows that about one in three of the children born were not intended.

In the Netherlands, these unintended births account for more than half the annual population growth. Moreover, the impact of these children during their lifetime is much greater than that of children born in developing countries, because the footprint of a Dutch personis much larger. See appendix 7.

If most unintended births all over the world were prevented, the population growth would come to a halt and eventually decline. The international community should thus give high priority to birth control, both by providing information and supplying safe and acceptable contraceptives to countries where these are not available.

It is also important that all people realise that they have a responsibility and that their choice to have children affects the size of the global population. The number of planned births will also have to fall, a process in which voluntary family planning plays a large part.

However, even in the current state of overshoot, we still see governments, political parties and churches encouraging people to have more children, rejecting the use of contraceptives and forbidding abortion. This must stop.

Economy

A quota system is mostly introduced when the need is highest; we need to realize that this is now the case. The resources needed to satisfy our demands are becoming more and more scarce. Already we are living beyond the Earth's capacity, in a situation of overshoot. Introducing a quota system is an effective way of adjusting our economy to the ecological capacity of the Earth. Moreover, it is socially just, not only locally within our own country, but also on a global scale, as we would no longer take resources from developing countries.

Proposals already exist, see appendix 4.

For example, at the moment the EU has a footprint of 2.5 billion global hectares (gha), while its biocapacity is only 1 billion gha.

By implementing a quota system this current footprint can be gradually reduced to fit the biocapacity. There needs to be agreement on the number of years we can allow ourselves to achieve this aim. This example shows that population decrease is not a goal in its own right, but it can, however, make it easier to achieve environmental sustainability. As the footprint per country decreases, the footprint per head of the population will shrink less quickly with a smaller population.

Epilogue

The authors are aware that subjects as shrinking of the economy through limiting consumption and reducing the population through voluntary birth control are controversial.

Since the 1970s, population control has been a taboo in Dutch politics, even though the Netherlands was considered to be overpopulated just after the Second World War with a population of 10 million; today it numbers almost 17 million. In 1976, a government report on population and welfare in the Netherlands, the Muntendam report, recommended government policies that would stabilize the population to number no more than 15 million before the turn of the century. The government endorsed this recommendation.

Once more we would like to emphasize that our main concern is bringing down the size of humanity's footprint so that is fits within the available biocapacity of the Earth. This can be achieved in two ways: by reducing the number of people or by lowering the footprint per person. Because of the enormity of this task, we advocate focussing on both.

For developing countries it is a different story. The footprint per person is very small, but the footprint per country is usually high because of the large population. Also here the population needs to shrink. Each country needs to look for its own solution. The international community may be able to help them achieve it.

We would like to point out that our recommendations will primarily concern the footprint and the population of the Netherlands and the European Union. Developing countries will generally benefit from the result.

We hope that people will find a way to work in harmony, within the natural limits of the Earth. Once people realise the need for a globally sustainable society, they will see that the only way forward is to reduce the number of children and the demand for material goods.

December 20, 2013, the Dutch Footprint Group

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Appendix 1: Ways to lower your individual footprint

Although there are many ways of lowering your individual footprint, the larger part is due to energy and food consumption. Therefore:

1. Eat more vegetable products and less meat, fish and dairy produce. On average halving these last three is feasible and even benefits our health.
2. Fly as little as possible; the emissions in the upper layers of the atmosphere affect the climate 2 to 3 times as much as those from traffic on the ground.
3. Reduce your heating costs; even old houses can be renovated to passive houses, that hardly use energy for heating. Choose green energy.
4. Travel as much as possible by public transport and avoid using your car. If you do use your car, become a fuel-efficient driver. Only use an electric car when green energy is available.
5. Use your bicycle more often, especially for short distances. This also improves your physical condition.
6. Use green electricity, as economically as possible. Use energy saving light bulbs, such as LED-lights, and only turn them on when you need to.
7. Buy electrical appliances only when really necessary; choose one with the most energy efficient A-rating.
8. Buy second-hand; you share the production footprint with the previous owners.
9. With regards to food, diminish your footprint by buying local produce, that is in season and organically grown. Packaging should be minimal. Throw away as little food as possible. Compost vegetable and fruit waste.
10. Choose presents with a small footprint, e.g. self-made jam or biscuits, a painting, or a ticket for the theatre.

Appendix 2: Ways the government of a developed country can help reduce the average footprint

1. **Reduce the use of fossil fuels**
   - A national isolation plan to stimulate energy saving.
   - Introduce a quota system for fossil fuels for private transport.
   - Introduce a 'feed-in' pricing system for sustainable energy, as in Germany.
2. **Greening the tax system**
   - Shift from taxing labour to taxing use of energy, minerals and land, these three being the 'commons' of our planet.
   - Maintain a low value-added tax rate (VAT) for all activities and products with a small footprint, such as second-hand shops, repair shops, biological food and clothing, and green energy.
3. **Reduce the need for newly extracted raw materials**
   - Tax the mining of mineral ore; give subsidies for minerals that are re-used or reclaimed.
4. **Promote healthy food produced locally**
   - Less dairy products, meat and fish, to be realised by a quota system.
   - Make local products recognizable by labelling.

5. **Creating awareness about the overshoot in the world**
   - Publish data on the footprint of consumer products.
   - Label products with their footprint. Start with the Carbon Footprint, later include the Water Footprint and the total footprint.
6. **Quota of footprint**
   - Ultimately, all measures result in a quota system by which each person gets a fair share of the resources that are still available.

Appendix 3: Proposals for instruments that can reduce the population of a developed country

7. **Education and communication of the world population problem**
   - Curricula for schools about the footprint.
   - Sex education including the use of contraception.
   - Explain the interdependency of economy, footprint and population density.
   - Promote public acceptance of childless or small families.
8. **Prevention of unplanned births**
   - Contraceptives and morning-after pill cheap and easily available.
   - The pill in all health insurance packages.
   - Increased budgets for family planning in own country as well as in developing countries.
9. **Financial regulations**
   - Tune financial regulations, such as child benefit, so that small families are stimulated and large families discouraged.

Appendix 4: Proposals for Quota systems

Several NGO's in Europe are together discussing various proposals for quota systems, helping them discover their common goals but also their differences.

- The **RCC Proposal** (of the *Resource Cap Coalition*, www.ceeweb.org /rcc) has a quota based on energy content which is expressed in MJoule. In common with the other proposals, its goal is to cap, limit, the use of non-renewable energy on a consumer level by allocating an equal amount of energy to each person. Companies would get their share via a special allocating system. Should under-consumers want to sell some of his quota, he would receive *quota money*, a alternative currency only valid on local ecological markets. In this way the regional economy would be stimulated. A *revolving fund* would help to finance environmentally friendly projects, such as the insulation of houses.
- The proposal of the Spanish group *Ecologistas en Acción* is very similar to the RCC Proposal.

- The British *Tradable Energy Quota* **(TEQ,** www.teqs.net) is also based on energy content. Every adult would receive a free entitlement of TEQs. Other energy users, such as factories, would have to buy their TEQs from an auction.
- The *Dutch Footprint Group* proposes extending the unit of quota, **Terra**, to the footprint. Individuals and government bodies receive their quota free of cost. Companies would pay and receive the quota after the whole production process and marketing had been taken into account, similarly to Value Added Tax (VAT). The energy companies and the farmers would form the end of the chain. See www.voetafdruk.eu/onzevoetafdruk/quotamechanisms.

The common purpose of these schemes is to limit the material use of goods, including energy. Because energy is a major factor in our consumption, the different proposals all point in the same direction.

The various proposals mainly differ in how far-reaching the scheme will be. The first three do not go so far as that of the Dutch Footprint Group. Moreover the Terra results from a more integral approach, but the system would also be probably more difficult to implement. On the other hand, the problem of import/export is then probably easier to solve.

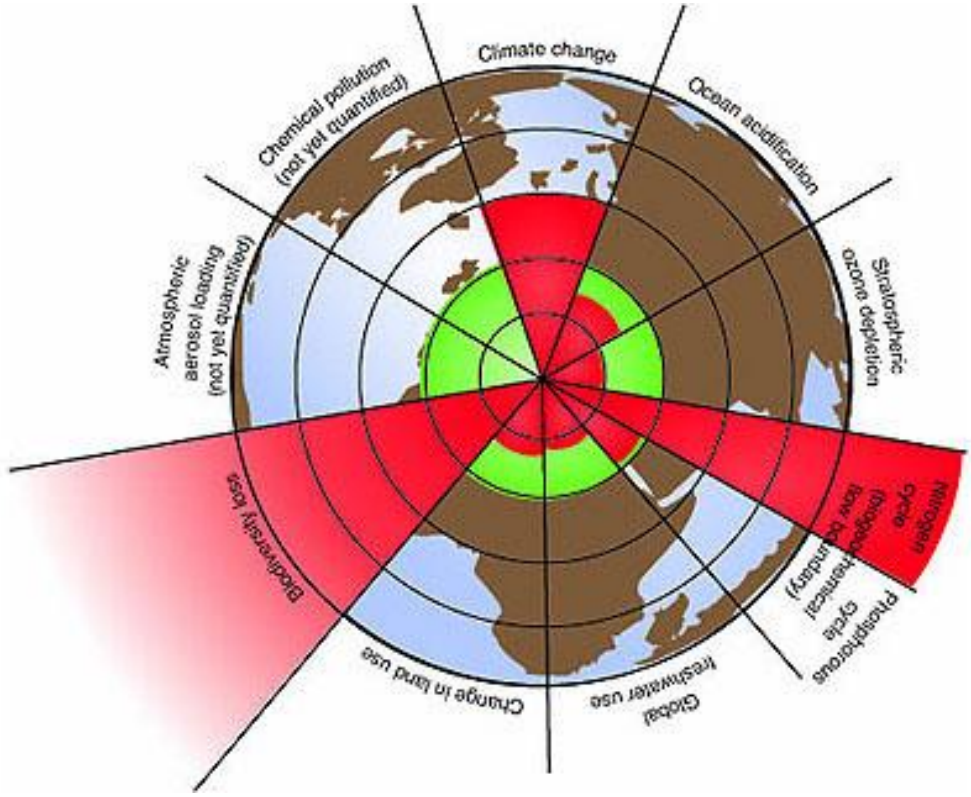
Appendix 5: Why the footprint of a country or a group of countries (EU) should not exceed its biocapacity

11. Although the problems associated with sustainability and population size are global, this should not get in the way of bringing them down to a level that is easier to grasp, and more manageable to do something about. The most obvious choice is that of an individual state or country. Its government imposes taxes and laws on its people and takes measures to achieve a balanced budget. Extending this budget to include a footprint that does not exceed the country's biocapacity seems obvious. Why allow a footprint deficit while it is generally agreed that a financial deficit is not acceptable? Also the UN regards countries as qualified to manage their own affairs. If desirable and practical, however, a group of countries, such as the EU, could take common measures.
12. Locally available resources, such as arable land, fishing grounds, minerals, fossil fuels and space in general, will become increasingly scarce. In principle, each country has the say on its own resources, that is, those that are found on its territory.
13. Increasing shortage of oil, and subsequently higher price, will force us to reshape our economy and use local resources when possible. The transport of goods over long distances will become too expensive.
14. Poor countries cannot pay for resources from abroad. Why should rich countries have a right to increase their biocapacity by buying the biocapacity of poor countries?
15. Space for nature should be reserved on each scale, municipality, province or country. Cities are so densely built-up, that they cannot meet this requirement. When countries use all their biocapacity for human consumption, there will be no space for nature.

16. According to article 1.2 of ICESCR (International Covenant on Economic, Social and Cultural Rights): "All peoples may, for their own ends, freely dispose of their natural wealth and resources without prejudice to any obligations arising out of international economic co-operation, based upon the principle of mutual benefit, and international law. In no case may a people be deprived of its own means of subsistence."

Appendix 6: Planetary boundaries

The diagram below is from the Stockholm Resilience Centre, whose director is Johan Rockström.



The scientists first identified the Earth System processes and then determined their potential biophysical thresholds. If one or more of these thresholds are crossed, unacceptable environmental change will follow.

They then proposed boundaries that should be respected in order to reduce the risk of crossing these thresholds.

Green (light grey) indicates the planetary boundary, red (dark grey) indicates the reserves or overshoot.

The nine boundaries concern:

- climate change
- stratospheric ozone layer
- land system change
- freshwater consumption and the global hydrological cycle
- biodiversity
- ocean acidification
- nitrogen and phosphorus inputs to the biosphere and oceans

- atmospheric aerosol loading (not yet quantified)
- chemicals dispersion (not yet quantified).

The study suggests that three of these boundaries (climate change, biodiversity and nitrogen input to the biosphere) may already have been crossed. The study also emphasizes that the boundaries are strongly interconnected; crossing one boundary may seriously threaten the ability to stay within safe levels of the others.

See: http://www.stockholmresilience.org/planetary-boundaries

Appendix 7: Unplanned pregnancies and unwanted births

Research shows that in developing countries, there were 76 million unintended pregnancies in 2008; these resulted in almost 30 million births. In the rich countries, unplanned births numbered 3 million. A *pregnancy* is defined as *unintended* when *two or more years earlier than intended* or when *the woman did not want (any more) children* (literature 12, 13, 15). These figures indicate that nearly half of the annual world population growth is not planned.

Other research shows that in the Netherlands, unplanned births account for more than half of the annual increase of the population (literature 14).

A large part of these pregnancies could have been prevented with contraceptives. Although many women do use them, it has been estimated that there are 215 million women in developing countries with an unmet need for contraception, resulting in 65 million unplanned births per year (literature 13). The cost of satisfying this unmet need is much smaller than the cost of health care for so many women who had not intended to become pregnant and their babies.

Much human misery could thus be avoided. At the same time, preventing unplanned pregnancies would be an important step towards stabilizing the world population (literature 15).

Appendix 8: Literature

(See www.voetafdruk.eu/onzevoetafdruk/literatuur)

17. Tim Jackson Prosperity without Growth. Earthscan, 2009.
18. Living Planet Report 2012. Try www.panda.org.
19. www.planet1st.nl the online wake-up call Planet First! December 2009 (in Dutch).
20. Jan Juffermans Nut & Noodzaak van de Mondiale Voetafdruk, on why we need to use the Global Footprint. Rotterdam, 2006. www.janjuffermans.nl (in Dutch).
21. Het standpunt van het Platform Duurzame en Sociale Economie (PDSE) over Bevolking en Voetafdrukken [the standpoint of the Forum for Sustainable and Social Economy] (in Dutch). www.economischegroei.net/?page_id=743 in particular www.economischegroei.net/file/313
22. David Fleming Energy and the Common Purpose (2005). An introduction to Tradable Energy Quotas (TEQs), a model he proposed as early as 1996. Download via www.theleaneconomyconnection.net. For recent information on TEQs see www.teqs.net
23. Bert Vink's proposal for a quota system based on the Footprint Model (in Dutch).
24. G.A. Biezeveld: Onze Ecologische Voetafdruk [Our Ecological Footprint]. How legislation can help to reduce our footprint. Inaugural speech, University of Groningen, 2009 (in Dutch).
25. Report of the workshop Reducing the Dutch Footprint, of the Biodiversity Taskforce organised in 2009 by the Dutch ministries of agriculture, nature and fisheries and of housing, planning and environment (in Dutch).
26. Hans Lyklema: Bevolkingsbeleid: Taboe of Noodzaak? [Population policy: taboo or necessity?] at conference of the Forum for Sustainable and Social Economy (PDSE) in Tilburg, 2010 (in Dutch).
27. Hans Lyklema: Maak duurzaamheid meetbaar [Make sustainability measurable], 2010 (in Dutch).
28. Singh et al.: Unintended Pregnancy: Worldwide Levels, Trends, and Outcomes. Studies in Family Planning 41: 241-250, 2010.
29. Reports on unplanned pregnancies and therefore often unwanted births, and ways of avoiding them. Guttmacher Institute in New York: www.guttmacher.org/pubs/gpr/14/3/gpr140302.html,. For further reading, see their reference list. 2012 report: www.guttmacher.org/pubs/AIU-2012-estimates.pdf
30. De Graaf & Loozen: Ongeplande zwangerschappen [Unplanned pregnancies]. Bevolkingstrends, CBS (Statistics Netherlands), 2005 (in Dutch).
31. R. Engelman: An end to population growth: why family planning is key to a sustainable future. Solutions 2011 www.thesolutionsjournal.com/node/919
32. Rob Hengeveld Wasted World: how our consumption challenges the planet. University of Chicago Press, 2012.