VLIR-BVO project 2003

‘Elaboration of the concept of ecological debt’

Final report
1 September 2004

Authors: **Erik Paredis**
Jesse Lambrecht
Gert Goeminne
Wouter Vanhove

Promotors: **Prof. Bernard Mazijn**
Prof. Frank Maes
Prof. Patrick Van Damme

With contributions from: **Leida Rijnhout**
Geert Fremout

Centre for Sustainable Development (CDO) – Ghent University
Poel 16, 9000 Gent, Belgium

Contents

This research project was funded by the Policy Preparation Research Program 2003 of the Flemish Interuniversity Council (Beleidsvoorbereidend Onderzoek 2003, Vlaamse Interuniversitaire Raad, VLIR)

Executive Summary

The aim of the research project 'Elaboration of the Concept of Ecological Debt' was to clarify the concept of ecological debt (state of affairs, definition, methodology, scientific frame of reference) and to study its relevance and applicability in Belgian and international policy. The research project focused on the ecological debt of countries and the consequences of this debt, such as the policy consequences on national level or in international negotiations. The question of ecological debt of companies was not treated, although it is touched upon a few times.

The research was divided into a core research and a modular research. The core research tried to clarify the concept in general terms. The modular research investigated the application of ecological debt in three fields: energy and climate change, agriculture and food supply, multilateral environmental agreements (MEAs). The project lasted from July 2003 till June 2004.

The study of literature in the ***core research*** *and discussions with NGO's participating in the campaigns on ecological debt taught that the concept is still in a developing phase. 'Ecological debt' was originally coined by South American NGO's in the beginning of the nineties and has since then been used primarily in awareness raising campaigns. Only a few scientific articles have been published on the concept. There seems to be a general understanding of what ecological debt is, but there is no univocal definition. Furthermore, there is no agreed on methodology to calculate ecological debt, either in physical or in monetary terms. Another proof that the concept is still developing, is the fact that the discussion on what should be done politically with ecological debt is very limited. Prominent demands are 'recognition' of the actual existence of ecological debt, 'compensation' for or 'reparation' of ecological debt from the past and 'avoiding new accumulations' in the future through restructuring of production and consumption patterns in industrialised countries.*

It is argued in this report that the weaknesses mentioned are rather on the level of operationalisation of the concept than on the level of the concept as such. The reality to which ecological debt refers cannot be denied: the historical and current ecological damage in other countries or to global ecosystems caused by industrialised countries and the over-use of ecosystem goods and services by industrialised countries are amply documented. Besides, the concept of ecological debt has characteristics which turn it into a potentially powerful tool for re-discussing relations between North and South or for re-thinking sustainable development policies. Characteristics mentioned are the historical perspective added to sustainable development, the reversal of the debtor-creditor perspective (with the North now in a debtor position and the South as creditor) and the uniting and articulation of comparable experiences from local groups in the South. Still, due to the 'operational' weaknesses, the usefulness of ecological debt in international policy and negotiations seems at the moment rather limited.

The research has shown that it should be possible to remedy these weaknesses. Through an analysis of the problem of defining concepts, a working definition was formulated for the ecological debt of countries:

> *"The ecological debt of country A consists of*
> *(1) the ecological damage caused over time by country A in other countries or in an area under jurisdiction of another country through its production and consumption patterns,*
> *and/or (2) the ecological damage caused over time by country A to ecosystems beyond national jurisdiction through its consumption and production patterns,*
> *and/or (3) the exploitation or use of ecosystems and ecosystem goods and services over time by country A at the expense of the equitable rights to these ecosystems and ecosystem goods and services by other countries or individuals."*

The proposed working definition allows for several refinements, e.g. refinements for what is meant by ecological damage, for spatial scales of damage, for equitable rights to ecosystem goods and services, for debtors and creditors, for time scales. Based on the working definition, definitions for other actors than countries can be formulated (e.g. ecological debt of companies).

The two main elements of the working definition ('ecological damage', 'use at the expense of equitable rights') lay the foundation for a methodology for calculating ecological debt in physical or monetary terms. The aspect 'ecological damage' can be measured by a combination of different indicators, which if desired can be organised through a DPSIR-framework. The aspect 'use at the expense of' can be measured by ecological footprints or environmental space. In general, the research favours the environmental space approach. Since the methodology has to be able to trace ecological damage or use elsewhere, a necessary underlying tool for calculating a lot of aspects of damage or use is material flow analysis. All these instruments calculate ecological debt in physical terms. A possible next step is a monetary valuation of this 'physical' ecological debt, for which purpose several techniques from neoclassical environmental economics are available. The research project evaluates physical and monetary calculations as complementary.

Apart from working on definitions and methodology, another important step for strengthening the concept of ecological debt is through further development of the underlying scientific frame of reference, i.e. making stronger connections between ecological debt and biophysical accounting systems, ecological economics, environmental justice and human rights, theories and state practices on historical injustices and restitution.

Even if it is possible to develop a 'strong' concept of ecological debt, there is no certainty that it will be used in national or international policy. The ***module on Multilateral Environmental Agreements (MEAs)*** *was meant to examine whether ecological debt can be integrated in international (environmental) law, what the obstacles are in the present context and what kind of solutions might be found.*

For the moment, there are no direct references to the concept of ecological debt in current MEAs. There exist, however, several links, i.e. principles or mechanisms that refer to aspects of ecological debt. Examples of principles are the principle of common but differentiated responsibilities, the principle of intra- and intergenerational equity and the polluter-pays principle. Examples of mechanisms are the Adaptation Fund under the Kyoto Protocol and the equitable benefit sharing under the Convention on Biological Diversity (CBD) and the International Treaty on Plant Genetic Resources (ITPGR). Apart from MEAs, relevant jurisdiction concerning state responsibility was examined, and a number of cases under the US Alien Tort Claims Act and before Human Rights Commissions or Committees were looked

at. The issue of state responsibility is certainly promising, but a lot of difficulties remain. Other links, to this day, are not part of international law, e.g. the Brazilian Proposal to share responsibility among the Annex I Parties to the UNFCCC on the basis of their contribution for the earth's mean surface temperature increase, and several political statements where the term 'ecological debt' is mentioned.

The most important legal obstacles for introducing the concept of ecological debt in international law are the sovereign rights of states over their natural resources and the fact that most of the links with the concept of ecological debt that were found are future-orientated. The latter poses a problem because of the inherent retroactive character of the concept of ecological debt. Furthermore, most links focus on pollution or damage in general (the first aspect of the working definition) and much less attention is being paid to the use of natural resources with equitable compensation (the other aspect of ecological debt).

As far as solutions are concerned, it is crucial to prevent a further build-up of the ecological debt e.g. through the promotion of environmental human rights (with the necessary consequences for the Northern way of life), the acceptance of intergenerational rights and the abandoning of certain sovereignty claims over natural resources. To receive compensation for the ecological debt accumulated in the past, one possible way is litigation, although a political solution could be based on an extensive interpretation of the principle of common but differentiated responsibilities or on reference to a growing state practice to provide compensation for historical injustices.

The ***module on energy and climate change*** *aimed at a calculation of part of Belgian's ecological debt, starting from a historical and quantitative analysis of the Belgian energy system. Belgium's wealth is based on a high level of energy consumption. The Belgian annual gross energy consumption has exponentially increased from 1,7 million TOE (Tons of Oil Equivalent) in 1830 up to 58,3 million TOE in 2000. A per capita approach shows an increase by a factor 12 in the same period, from 0,5 TOE in 1830 to 5,7 TOE in 2000, the latter being almost four times the world average per capita consumption in 2000. Belgium's high level of fossil energy consumption contributes to the depletion of this finite resource and this happens at the expense of the equitable rights to these resources not only of other countries but also of future generations, namely by depriving them of the possibility to benefit from the use of these resources.*

The research also showed that during its 170 years of existence, Belgium has evolved from being 100% self-supporting in its energy needs, mainly by coal, to being almost 100% dependent on imports of energetic resources, mainly fossil fuels complemented with nuclear fuel. By switching to imported energy carriers, Belgium has accumulated ecological debt by passing the ecological damage from the extraction process on to other countries.

Regarding the CO_2 emissions due to fossil fuel combustion, the research show that Belgium's CO_2 emission level has increased from 5 million tons of CO_2 in 1830 up to 115 million tons in 2000, reaching a maximum of 137 million tons in 1979. On a per capita basis Belgium has since 1900 constantly emitted two to three times the world average amount and, from 1975 on, its CO_2 emissions have exceeded by a factor five the sustainable level suggested by the IPCC (Intergovernmental Panel on Climate Change) for all greenhouse gasses combined. Both aspects of ecological debt due to CO_2 emissions, causing ecological damage and overusing the absorption capacity of the atmosphere, make up the so-called 'carbon debt' of Belgium.

In this research, two simple models have been used to split up the total carbon debt in an intra-generational interstate debt, the 'historical carbon debt', and an inter-generational debt towards future generations, the 'generational carbon debt'. Analytic expressions are given for both models, presenting a way of calculating the historical and generational carbon debt and thus the total carbon debt of a country, given its historic emission profile. The Belgian total carbon debt, accounted over the period 1900-2003, amounts to 4234 million tons of CO_2 according to one model, and to 5787 million tons according to the other, which can be compared to a total CO_2 emission of 115 million ton CO_2 in 2001. A monetary valuation of this carbon debt can make use of estimates of the price of one ton of CO_2 based on proposed non-compliance penalty mechanisms, market prices etcetera, leading to a value ranging from 1 € up to 100 € per ton CO_2 emitted. Using by way of example a very reasonable 10 € per ton CO_2 gives a total Belgian carbon debt of 42 or 58 billion € (depending on the model used). Using the same calculation methods, but with figures from 1950-2000, it becomes possible to calculate carbon debts/credits for other countries, resulting e.g. in a carbon credit between 505 and 726 billion € for India and between 27 and 38 billion € for Congo.

A preliminary proposal on how these concepts could be brought into practice has been elaborated including an emission rights system which embodies compensation for the historical carbon debt. In this proposal, 'debtors' compensate 'creditors' by realising extra emission reductions and thus giving creditors extra emission rights. In this way industrialised countries would take the lead in combating climate change, whereas developing countries temporarily get the opportunity to develop with fossil fuels.

*The **module on agriculture and food supply** focused on one particular part of Belgian agriculture, namely the livestock sector which has a large share in Belgium's foreign trade of agricultural commodities. In the research, fodder crop flows from all foreign countries towards Belgium were analysed and total land surfaces to produce these crops were calculated. An assessment was made of the area in several countries that is designed for export production to the Belgian livestock sector. The latter can be regarded as one (but important) part of the ecological footprint of Belgium in these countries.*

Material flow analyses were performed making use of the Belgian Statistics on Foreign Trade. Net imports of 18 fodder crops were analysed, making it possible to distinguish two main groups of fodder crops. The 'protein' group consists of oilseeds from soy, groundnut, cotton, sunflower, rape, flax, coconut and oil palm, and of peas and alfalfa. The starch group contains cassava, corn, wheat, barley, rye, oat, sorghum and millet. It was found that fodder crop net flows toward the Belgian livestock sector quadrupled since 1960 and is still increasing with some 140 000 tonnes annually. Currently, soybeans and wheat imports are predominant. Although material flows are still increasing annually, total land requirement abroad to produce fodder crops for the Belgian livestock sector has since 1975 been around 2.5 million ha, which is some 250 % of total available arable land inside Belgium. As a result of improved yield of fodder crops, the same land surface is sufficient to produce higher amounts of fodder commodities. Soy annual land requirement abroad is currently around 500 000 ha, sunflower annual land requirement is some 250 000 ha and linseed annual land requirement around 200 000 ha. Within the starch group, annual land requirement for wheat is currently around 400 000 ha; annual land requirement for barley is around 250 000 ha. Due to a recent rise in domestic corn cultivation (an efect of legislation on use of manure), current land requirement abroad for corn has reduced from around 300 000 ha to around 100 000 ha today. Main countries of production of fodder crops for Belgium are Argentina,

Brazil, France, USA and Canada. Within these five countries, the Latin American share (Brazil and Argentina) in land requirement for fodder crops increased in absolute terms over time, but also relatively compared to the whole of land requirement in the 5 countries (two thirds in the last decade). Although until 1990, land requirement in the USA has been substantial, in the last decade it vanished almost completely.

Cultivating vast areas of fodder crops abroad inevitably brings about ecological damage, of which the impact is not directly affecting the Belgian consumer. Monocultures of fodder crops mainly cause pollution of surface water by massive pesticide and fertilizer application. They also provoke a chain of other negative interferences with the environment where deforestation occurs or GMOs are applied. The DPSIR indicator framework was evaluated as valuable for describing interferences of agricultural production with four environmental components (fauna and flora, soils, water and atmosphere), but the assumption of linear cause and effect chains is an obstacle for an assessment of ecological damage as a result of agriculture. Furthermore, this assessment is very complex since it depends on the country of production, the nature of the crop and applied cultivation methods. A case study of soybean production in Brazil for the Belgian livestock sector demonstrated this complexity. The case study could not yield an adequate ecological damage measure per surface unit.

Another aspect of ecological debt is the unequal distribution and use of world-wide arable land. Belgium exceeds the average world per capita land requirement for fodder crops with a factor two. While for the quantification of carbon debt (see above) it is possible to rely on IPCC data to define a 'sustainable level' of CO_2 emissions, the same kind of generally accepted reference cannot be found for space-related aspects of fodder crop production. When, following research from the Wuppertal Institute, self-sufficiency on a continental scale is assumed using ecological farming methods, a per capita mid-term target level (0.047 ha) is exceeded with a factor four. Because of the particular assumptions, it is only one of many future scenarios. Further research is needed to obtain one or more well-defined sustainability target levels for fodder crop land distribution. Anyhow, land requirement for fodder crops is clearly related to Belgian (or European) food consumption patterns. An affluent (meat rich) diet requires at least 3 times as much cultivation area as a vegetarian diet.

It is clear from the research that the Belgian livestock sector is maintained only through the import of massive amounts of fodder crops. The international dependence of the Belgian livestock sector is rooted in the Common Agricultural Policy (CAP) of the EU which Belgium helped establish in the late 1950s. From the very beginning, the CAP brought undesired effects along. While farmers' income remained relatively low, overproduction of animal products occurred due to a price-support policy adopted by the CAP. Although the direct price support to EU farmers is currently being cut down and overproduction has been reduced as a result, material flows of raw fodder commodities from developing countries to Belgium (and the EU in general) and concomitant ecological damage is still increasing. These agricultural trade relations are reinforced by Structural Adjustment Programs (SAPs) imposed by international financial institutions (World Bank and IMF) and by the international trade agreements of the World Trade Organisation (WTO). Current trade regimes between South and North sustain ecological damage in the South and current global inequity in arable land use.

Next to internalising costs of ecological damage in world market prices of fodder commodities, a change in Belgian and European consumption patterns and agricultural policy is an important element in reducing Belgium's ecological debt as a result of its

livestock production. Besides implementation in relevant domestic policies, both elements should be brought at the negotiation table of the WTO or the CAP by the Belgian government.

*The results of the research make it possible to sketch a broad picture of **policy implications**. The two aspects of ecological debt – 'ecological damage' and 'use at the expense of equitable rights' – can be targeted through two kind of policy interventions, i.e. accounting for historical responsibility and avoiding daily accumulation. For some domains implications are clearer than for others, with climate and energy policies possibly being the best point of departure for introducing some notion of historical ecological debt. In the debate on external debt, debt cancellations are long overdue and here ecological debt can be an additional argument. Development cooperation policy can play a role in identifying cases of ecological debt accumulation in partner countries and in stimulating and starting projects which can stop this accumulation. Trade policies should be reformed in order to avoid ecologically unequal exchange between countries.*

Even in cases where it is for the moment not possible to strictly identify and calculate ecological debt such as it has been defined in this research project (e.g. in the case of fodder crop production), it remains nevertheless essential to identify the impacts of industrial countries' policies abroad and on global ecosystems, and then to diminish their impacts. This point of view should become an integral part of sound sustainable development policies, even if it is not explicitly called ecological debt. Ignoring these issues and exclusively focusing on sustainability issues in Belgium and Europe, will create the illusion that "all is well", while the negative externalities of Northern production and consumption patterns are passed on to other countries and future generations. In this sense, the insights and methodology which have been developed during the project are probably more widely relevant than the strict debate on ecological debt. They can become tools for broadening the view on what sustainability means, and more in particular on what the impacts are of physical-ecological relations between nations, now, in the past and in the future, under business-as-usual policies or under revised policies.

All in all, furthering the debate on ecological debt will probably need different forms of 'capacity building': awareness raising with the general public but also with politicians and civil society, intense lobbying at different policy levels and forging links with sympathizing politicians, more profound scientific research, networking between South and North at the level of civil society, politics and research.

Samenvatting

Het doel van het onderzoeksproject 'Uitwerking van het concept ecologische schuld' was het uitklaren van het concept ecologische schuld (stand van zaken, definitie, methodologie, wetenschappelijk referentiekader) en het bestuderen van de relevantie en toepasbaarheid ervan in Belgisch en internationaal beleid. Het project is toegespitst op de ecologische schuld van landen en de gevolgen van die schuld, o.a. de beleidsgevolgen op nationaal vlak en internationale onderhandelingen. De problematiek van de ecologische schuld van bedrijven wordt niet behandeld, hoewel ze enkele keren aan bod komt.

Het onderzoek is verdeeld in een kernonderzoek en een modulair onderzoek. Het kernonderzoek tracht het concept in zijn algemeenheid uit te klaren. Het modulair onderzoek bekijkt de toepassing van ecologische schuld in drie domeinen: energie en klimaatverandering, landbouw en voedselvoorziening, multilaterale milieuakkoorden. Het project liep van juli 2003 tot juni 2004.

*Uit de literatuurstudie tijdens het **kernonderzoek** en uit discussies met ngo's die deelnemen aan de campagnes rond ecologische schuld, blijkt dat het concept nog in een ontwikkelingsfase zit. De term 'ecologische schuld' werd voor het eerst gebruikt door Zuid-Amerikaanse ngo's in het begin van de jaren negentig en is sindsdien vooral gebruikt in bewustmakingscampagnes. Er zijn slechts enkele wetenschappelijke artikels gepubliceerd over het concept. Er lijkt een algemeen inzicht te bestaan in wat ecologische schuld is, maar er is geen eensluidende definitie. Bovendien bestaat er geen overeengekomen methodologie om ecologische schuld te berekenen, noch in fysische noch in monetaire termen. Een ander bewijs dat het concept nog in ontwikkeling is, is het feit dat het debat over wat er politiek gezien met ecologische schuld moet gebeuren, erg beperkt is. De belangrijkste eisen zijn 'erkenning' van het bestaan van ecologische schuld, 'compensatie' voor of 'herstel' van ecologische schuld uit het verleden en 'nieuwe opbouw vermijden' in de toekomst door een herstructurering van de productie- en consumptiepatronen van industrielanden.*

Dit rapport beargumenteert dat die zwakke punten eerder moeten gesitueerd worden op het niveau van de operationalisering van het concept dan op het niveau van het concept als dusdanig. De realiteit waarnaar ecologische schuld verwijst, kan niet ontkend worden: de historische en huidige ecologische schade die door industrielanden wordt veroorzaakt in andere landen of aan globale ecosystemen is uitgebreid gedocumenteerd, net zoals het overgebruik van ecosysteemgoederen en diensten. Daarnaast bezit het concept ecologische schuld kenmerken die het tot een potentieel krachtig instrument maken om de relaties tussen Noord en Zuid opnieuw te bediscussiëren en om het beleid voor duurzame ontwikkeling te herdenken. Kenmerken die vermeld worden zijn het historische perspectief dat toegevoegd wordt aan duurzame ontwikkeling, de omkering van het debiteur-crediteurperspectief (met het Noorden nu in een debiteurpositie en het Zuiden als crediteur) en het samenbrengen en vertolken van vergelijkbare ervaringen van lokale groepen in het Zuiden. Echter, omwille van de 'operationale' zwaktes van het concept, lijkt de bruikbaarheid van ecologische schuld in internationale onderhandelingen en beleid momenteel eerder beperkt.

Het onderzoek heeft aangetoond dat het mogelijk moet zijn om aan die zwaktes te verhelpen. Via een analyse van het probleem van definitie van concepten, werd een werkdefinitie geformuleerd voor de ecologische schuld van landen:

> *"De ecologische schuld van land A bestaat uit:*
> *(1) de ecologische schade die in de loop van de tijd door de productie- en consumptiepatronen van land A veroorzaakt is in andere landen of in een gebied onder jurisdictie van een ander land*
> *en / of (2) de ecologische schade die in de loop van de tijd door de productie- en consumptiepatronen van land A veroorzaakt is aan ecosystemen die vallen buiten nationale jurisdictie*
> *en / of (3) de exploitatie of het gebruik van ecosystemen en ecosysteemgoederen en -diensten in de loop van de tijd door land A ten koste van de billijke rechten op deze ecosystemen en ecosysteemgoederen en –diensten van andere landen of individuen.*

De voorgestelde werkdefinitie maakt verschillende verfijningen mogelijk, bijvoorbeeld verfijningen voor de invulling van ecologische schade, voor ruimtelijke schalen van schade, voor billijke rechten op ecosysteemgoederen en –diensten, voor debiteuren en crediteuren, voor tijdsschalen. Op basis van de werkdefinitie, kunnen definities worden geformuleerd voor andere actoren dan landen (bijvoorbeeld voor de ecologische schuld van bedrijven).

De twee belangrijkste elementen van de werkdefinitie ('ecologische schade' en 'gebruik ten koste van billijke rechten') leggen de basis voor een methodologie om ecologische schuld te berekenen in fysische of monetaire termen. Het aspect 'ecologische schade' kan gemeten worden met een combinatie van verschillende indicatoren, die indien gewenst geordend kunnen worden in een DPSIR-kader. Het aspect 'gebruik ten koste van billijke rechten' kan gemeten worden met ecologische voetafdrukken of met de milieugebruiksruimte. In het algemeen is het onderzoek voorstander van een benadering via de milieugebruiksruimte. Omdat de methodologie in staat moet zijn ecologische schade of gebruik elders op te sporen, is materiaalstroomanalyse (material flow analysis) een noodzakelijk onderliggend instrument voor heel wat aspecten van schade en gebruik. Al deze instrumenten berekenen ecologische schuld in fysische termen. Een mogelijke volgende stap is een monetaire waardering van deze 'fysische' ecologische schuld. Daarvoor zijn er verschillende technieken uit de neoklassieke economie beschikbaar. In het onderzoeksproject worden fysische en monetaire berekeningen als aanvullend beschouwd.

Een andere belangrijke stap om het concept ecologische schuld te versterken – naast werk maken van definities en methodologie – is de verdere ontwikkeling van het onderliggende wetenschappelijk referentiekader, bijvoorbeeld door het leggen van sterkere verbanden tussen ecologische schuld en biofysische rekensystemen, ecologische economie, 'environmental justice' en mensenrechten, theorieën en statenpraktijken rond historisch onrecht en herstel.

Zelfs als het mogelijk is een 'sterk' concept van ecologische schuld te ontwikkelen, is er geen zekerheid dat dit ook gebruikt zal worden in nationaal of internationaal beleid. ***De module Multilaterale Milieuakkoorden (Multilateral Environmental Agreements - MEAs)*** *was bedoeld om te onderzoeken of ecologische schuld geïntegreerd kan worden in het internationale (milieu)recht, wat de moeilijkheden zijn in de huidige context en welke mogelijke oplossingen gevonden kunnen worden.*

Op dit moment zijn er geen directe verwijzingen naar het concept van ecologische schuld in de huidige MEAs. Er bestaan echter wel verschillende aanknopingspunten: principes of mechanismen die verwijzen naar aspecten van ecologische schuld. Voorbeelden van principes zijn het principe van de gemeenschappelijke maar gedifferentieerde verantwoordelijkheid, het principe van intra- en intergenerationele billijkheid en het 'vervuiler betaalt' principe.

Voorbeelden van mechanismen zijn het Adaptatie Fonds bij het Kyoto Protocol en de 'billijke verdeling van voordelen' bij het Biodiversiteitsverdrag en het International Verdrag betreffende Plantaardige Genetische Hulpbronnen. Naast MEAs is er ook onderzoek gedaan naar relevante rechtspraak inzake staatsaansprakelijkheid, alsook een aantal rechtszaken onder de Amerikaanse Alien Tort Claims Act en voor Mensenrechtencommissies of comités. Het thema van staatsaansprakelijkheid is zeker beloftevol, maar er blijven nog heel wat moeilijkheden bestaan. Andere links maken tot op vandaag nog geen deel uit van het internationale recht, bijvoorbeeld het 'Brazilian Proposal' om de lasten van Annex I landen bij het Klimaatverdrag te verdelen op basis van hun bijdrage aan de globale temperatuurstijging en verschillende politieke verklaringen waar de term 'ecologische schuld' wordt vernoemd.

De belangrijkste juridische moeilijkheden om het concept van ecologische schuld in het internationale recht te introduceren, situeren zich op het vlak van de soevereine rechten van staten over hun natuurlijke rijkdommen, en het feit dat de meeste van de links die gevonden werden, toekomstgericht zijn. Dit laatste vormt een probleem omwille van het inherent retroactieve karakter van het concept. Verder is het opvallend dat de meeste aanknopingpunten zich richten op vervuiling of schade in het algemeen (het eerste aspect van ecologische schuld) en wordt er veel minder aandacht besteed aan het gebruik van natuurlijke rijkdommen tegen een billijke vergoeding (het andere aspect van ecologische schuld).

Wat mogelijke oplossingen betreft, is het cruciaal om een verdere opbouw van ecologische schuld te vermijden, bijvoorbeeld door de bevordering van mensenrechten op. het milieuvlak (met de nodige implicaties voor de Noordelijke levensstijl), de aanname van intergenerationele rechten en het opgeven van bepaalde soevereiniteitsclaims over natuurlijke rijkdommen. Om compensatie te ontvangen voor de ecologische schuld die in het verleden is opgebouwd, is procesvoering een mogelijke oplossing, hoewel een politieke oplossing gebaseerd zou kunnen worden op een ruime interpretatie van het principe van de gemeenschappelijke maar gedifferentieerde verantwoordelijkheid of door verwijzing naar de groeiende statenpraktijk om historische onrechtvaardigheden te compenseren.

De ***module over energie en klimaatverandering*** *had de bedoeling om een deel van de Belgische ecologische schuld te berekenen, vertrekkend van een historische en kwantitatieve analyse van het Belgische energiesysteem. De welvaart van België is gebaseerd op een hoog energiegebruik. De totale bruto hoeveelheid energie die jaarlijks in België verbruikt wordt, is exponentieel gestegen van 1,7 miljoen ton olie equivalent (TOE) in 1830 naar 58,3 TOE in 2000. Een per capita benadering toont in dezelfde periode een stijging met een factor 12 van 0,5 TOE naar 5,7 TOE, wat gelijk staat aan bijna 4 keer het wereldgemiddelde per capita verbruik in 2000. Het massale gebruik van fossiele brandstoffen in België draagt bij tot de uitputting van deze eindige grondstof waardoor niet alleen andere landen het recht wordt ontzegd op hun rechtmatig deel maar ook toekomstige generaties de kans wordt ontnomen gebruik te maken van de ontwikkelingsmogelijkheden die fossiele brandstoffen bieden.*

Het onderzoek toont ook aan dat België in zijn ruim 170-jarig bestaan geëvolueerd is van een toestand gekenmerkt door een zelfvoorzieningsgraad van 100%, voornamelijk ingevuld door eigen steenkool, naar een quasi 100% afhankelijkheid van geïmporteerde energetische grondstoffen, in hoofdzaak fossiele brandstoffen aangevuld met nucleaire brandstof. Met de overschakeling op geïmporteerde energiedragers heeft België in de loop der jaren een ecologische schuld opgebouwd door de vervuiling die gepaard gaat met het ontginningsproces af te schuiven op andere landen.

Voor de CO_2 emissies uit de verbranding van fossiele brandstoffen, laten de berekeningen zien dat het emissieniveau gestegen is van 5 miljoen ton CO_2 in 1830 tot 115 miljoen ton in 2000 met een maximum van 137 miljoen ton in 1979. Op een per capita basis heeft België sinds 1900 voortdurend 2 tot 3 keer meer uitgestoten dan het wereldgemiddelde en vanaf 1975 overschrijden de CO_2 emissies van fossiele brandstoffen 5 tot 6 keer het niveau dat door het IPCC als duurzaam wordt beschouwd voor alle broeikasgassen samen. Beide aspecten van ecologische schuld ten gevolge van CO_2-uitstoot – het veroorzaken van ecologische schade en het overmatig gebruik van de CO_2 absorptiecapaciteit van de atmosfeer – behoren tot de zogenaamde 'koolstofschuld' van België.

Op basis van twee eenvoudige modellen is in dit onderzoek aangetoond dat de koolstofschuld van een land op te splitsen valt in een intragenerationele schuld tussen landen, de 'historische koolstofschuld', en een intergenerationele schuld ten opzichte van toekomstige generaties, de zogenaamde 'generationele koolstofschuld'. Voor beide modellen zijn rekenregels opgesteld die toelaten om de koolstofschuld, uitgesplitst naar het historische en het generationele deel, te berekenen. De Belgische totale koolstofschuld, gerekend over de periode 1900-2003, bedraagt 4234 miljoen ton CO_2 volgens het ene model, 5787 miljoen ton CO_2 volgens het andere. Ter vergelijking: de CO_2 uitstoot in 2001 bedroeg 115 miljoen ton. Voor een monetaire waardering van deze koolstofschuld kan gebruik gemaakt worden van prijsschattingen voor een ton CO_2 gebaseerd op marktprijzen, op voorstellen voor een bestraffingsmechanisme bij niet-naleving (non-compliance) enzovoort. Dat levert een waarde op van 1 € tot 100 € per uitgestoten ton CO_2. Als voorbeeld kan de totale Belgische koolstofschuld berekend worden aan een zeer redelijke 10 € per ton, wat een schuld geeft van 42 of 58 miljard Euro (afhankelijk van het gebruikte model). Met behulp van dezelfde berekeningsmethodes, maar met cijfers van 1950 tot 2000, is het mogelijk om koolstofschuld of –kredieten te berekenen voor andere landen, wat bijvoorbeeld resulteert in een koolstofkrediet tussen 505 en 723 miljard € voor India en tussen 27 en 38 miljard € voor Congo.

In het onderzoek is een eerste voorstel uitgewerkt over hoe deze concepten in de praktijk gebracht kunnen worden in toekomstige klimaatsonderhandelingen, met o.a. een emissierechtensysteem dat rekening houdt met compensatie voor historische koolstofschuld. 'Crediteuren' zouden daarin van 'debiteuren' in de toekomst een compensatie krijgen in de vorm van extra emissierechten en vice versa voor debiteuren die deze compensatie dienen te 'betalen' door het op zich nemen van extra emissiereducties. Op die manier nemen de geïndustrialiseerde landen het voortouw in het bestrijden van het klimaatprobleem en krijgen ontwikkelingslanden tijdelijk de gelegenheid om in hun ontwikkeling te voorzien met fossiele brandstoffen.

*De **module over landbouw en voedselvoorziening** richtte zich op een specifiek onderdeel van de Belgische landbouw, namelijk de veeteeltsector, die een groot aandeel heeft in de Belgische handel in landbouwgewassen. In het onderzoek worden alle handelsstromen van veevoedergewassen van het buitenland naar België geanalyseerd en wordt de totale benodigde landbouwoppervlakte berekend om deze gewassen te produceren. Er wordt een schatting gemaakt van hoe dit landgebruik is verdeeld over de verschillende landen waarin de naar België geëxporteerde teelten worden geproduceerd. Dit laatste vormt een belangrijk deel van de ecologische voetafdruk van België in de onderscheiden landen.*

Met behulp van de Statistieken van de Buitenlandse Handel van België werd een analyse gemaakt van de netto materiaalstromen naar de Belgische veeteeltsector. De netto-import van 18 voedergewassen werd geanalyseerd, onderscheiden in twee grote groepen. De 'eiwit' groep bestaat uit erwten, luzerne en oliezaden van: soja, pinda, katoen, zonnebloem, koolzaad, lijnzaad, kokosnoot en oliepalm. De 'zetmeel' groep omvat maniok, maïs, tarwe, gerst, rogge, haver, sorghum en gierst. Sedert 1960 zijn de netto stromen van voedergewassen naar de Belgische veeteeltsector verviervoudigd. Tot op vandaag neemt deze hoeveelheid jaarlijks toe met 140 000 ton. Momenteel zijn de import van soja en tarwe de belangrijkste handelsstromen van voedergewassen naar de Belgische veeteeltsector. Hoewel de netto invoer van voedergewassen jaarlijks nog steeds stijgt, bleef het totale landgebruik in het buitenland voor productie van deze gewassen sedert 1975 ongeveer constant rond de 2.5 miljoen ha, zo'n 250 % van de totale in België beschikbare landbouwoppervlakte. Dit is het gevolg van een verhoogde opbrengst per ha van voedergewassen waardoor meer geproduceerd kan worden op eenzelfde landbouwoppervlakte. Het jaarlijks landgebruik voor productie van soja is momenteel ongeveer 500 000 ha, voor zonnebloemen 250 000 ha en voor lijnzaad 200 000 ha. Bij de 'zetmeelgroep' bedraagt het jaarlijks landgebruik rond de 400 000 ha; rond de 250 000 ha voor gerst. Als gevolg van het Vlaamse mestdecreet wordt in België merkelijk meer maïs geteeld. Hierdoor is het jaarlijks landgebruik voor maïsteelt in het buitenland recent teruggevallen van 300 000 ha tot 100 000 ha. De belangrijkste landen waarin voedergewassen voor de Belgische veeteeltsector worden geteeld zijn: Argentinië, Brazilië, Frankrijk, de VS en Canada. Binnen deze vijf landen, steeg het absolute Zuid-Amerikaanse aandeel (Argentinië en Brazilië) in het totale landgebruik met de jaren, maar ook relatief gezien stijgt het aandeel van Zuid-Amerika in deze groep van vijf landen (2/3 van het totale landgebruik in het laatste decennium). Hoewel het landgebruik van de Belgische veevoedersector in de Verenigde Staten tot in 1990 aanzienlijk was, viel dit bijna volledig op nul in het laatste decennium.

Het bebouwen van grote landbouwoppervlaktes met voedergewassen brengt onvermijdelijk ecologische schade met zich mee. De impact hiervan is meestal niet voelbaar bij de Belgische consument. Monoculturen van voedergewassen veroorzaken vervuiling van oppervlaktewater door het massaal aanwenden van pesticiden en meststoffen. Ze liggen ook aan de basis van een keten van milieuvervuilende processen, vooral waar ontbossing voor de teelt is vereist of waar genetisch gemodificeerde organismen in monocultuur worden aangewend. De verstoring van 4 milieucomponenten (fauna en flora, bodem, water en atmosfeer) als gevolg van intensieve landbouwproductie werd nagegaan aan de hand van een indicatorsysteem: het DPSIR kader. Hoewel dit kader als waardevol werd aanzien bij het structureel in kaart brengen van milieuproblemen ten gevolge van intensieve landbouwproductie, werd de veronderstelling van lineaire oorzaak- en gevolgrelaties eerder als een obstakel ervaren. De complexiteit van het in kaart brengen van de totale milieuschade als gevolg van de teelt van voedergewassen voor de Belgische veeteeltsector wordt bovendien vergroot door een aantal andere factoren: het soort gewas, het land van productie en de gebruikte teeltmethodes, die allen in meer of mindere mate kunnen variëren. Ook een gevalstudie rond sojateelt in Brazilië voor de Belgische veeteeltsector kon geen adequate meeteenheid voor ecologische schade per oppervlakte eenheid aan het licht brengen.

Een tweede aspect van ecologische schuld is de ongelijke verdeling en gebruik van landbouwgrond wereldwijd. België overschrijdt het gemiddelde mondiale landgebruik per capita voor voedergewassen met een factor 2. Voor de kwantificering van koolstofschuld (zie boven) is het mogelijk om terug te vallen op IPCC gegevens voor de definitie van een 'duurzaam niveau' van CO_2 uitstoot, maar een vergelijkbare algemeen aanvaarde referentie

is er niet voor de ruimte-gerelateerde aspecten van veevoederproductie. Het Wuppertal Instituut schuift een streefwaarde op de middellange termijn naar voren (0.047 ha per capita), maar die wordt met een factor 4 overschreden. Deze streefwaarde gaat echter uit van een aantal veronderstellingen: landbouwproductie wordt op continentale schaal zelfvoorziend en gebruikt enkel ecologische teeltmethodes. Door die specifieke veronderstellingen, is dit slechts één van de vele mogelijke toekomstscenario's. Er is verder onderzoek nodig om één of meer duidelijk afgebakende streefwaarden voor veevoederproductie naar voren te schuiven. In elk geval is het landgebruik voor de productie van voedergewassen op globale schaal sterk verbonden met het Belgische (en Europese) voedingspatroon. Voor een (vlees)rijk dieet is immers tot driemaal meer landgebruik vereist dan voor een vegetarisch dieet.

Het is duidelijk dat de Belgische veeteeltsector slechts in stand wordt gehouden dankzij een massale import van voedergewassen. De internationale afhankelijkheid van de Belgische veeteeltsector vindt zijn oorsprong in het Gemeenschappelijk Landbouwbeleid (GLB) van de EU. Dit beleid werd in de jaren '50 door België mee opgestart. Kort na de introductie van het GLB kwamen echter een aantal ongewenste effecten aan het licht. Als een gevolg van de prijssteun binnen het GLB ontstond overproductie van dierlijke producten terwijl het landbouwinkomen relatief laag bleef. Hoewel de directe prijssteun voor Europese landbouwers momenteel wordt afgebouwd, en de overproductie bijgevolg vermindert, nemen de fysische handelsstromen van voedergewassen naar de EU en de bijhorende milieuschade nog steeds toe. De handelsrelaties tussen Noord en Zuid op vlak van landbouw worden versterkt door de Structurele Aanpassingsprogramma's (SAP's), opgelegd door internationale financiële instellingen als het IMF en de Wereldbank, en door de internationale handelsovereenkomsten van de Wereldhandelsorganisatie (WHO). Het huidige handelsstelsel houdt de ecologische schade in het Zuiden en het ongelijke landgebruik in stand.

Naast een internalisering van ecologische schade in de wereldmarktprijzen van veevoedergewassen, is een verandering in Belgische en Europese consumptiepatronen en landbouwbeleid een belangrijk element om de Belgische ecologische schuld ten gevolge van veeteelt te verminderen. Naast de implementatie in relevante binnenlandse beleidsdomeinen, zouden beide elementen door de Belgische overheid op de onderhandelingstafel van de WHO of het GLB moeten worden gebracht.

De resultaten van het onderzoek maken het mogelijk een breed beeld te schetsen van ***beleidsimplicaties****. De twee aspecten van ecologische schuld – 'ecologische schade' en 'gebruik ten kosten van billijke rechten' – kunnen aangepakt worden via twee soorten beleidsinterventies, namelijk het in rekening brengen van historische verantwoordelijkheid en het vermijden van dagelijkse schuldopbouw. Voor sommige beleidsdomeinen zijn de implicaties duidelijker dan voor andere. Klimaat- en energiebeleid zijn waarschijnlijk het beste aanknopingspunt om een notie van historische ecologische schuld te introduceren. In het debat over externe, financiële schuld had schuldkwijtschelding al lang moeten gebeuren en kan ecologische schuld als een bijkomend argument daarvoor gebruikt worden. Het beleid rond ontwikkelingssamenwerking kan een belangrijke rol spelen in de identificatie van schuldopbouw in partnerlanden en in het stimuleren en opstarten van projecten die die opbouw kunnen stoppen. Het handelsbeleid moet hervormd worden om ecologisch ongelijke ruil tussen landen te vermijden.*

Zelfs in gevallen waarin het momenteel niet mogelijk is om een strikte afbakening en berekening te maken van ecologische schuld zoals gedefinieerd in dit project (bijvoorbeeld in

het geval van productie van veevoedergewassen), blijft het essentieel om eerst de impact van het beleid van industrielanden elders en op globale ecosystemen in kaart te brengen en daarna die impact te verminderen. Dit uitgangspunt zou integraal deel moeten uitmaken van een degelijk duurzaam ontwikkelingsbeleid, zelfs wanneer de term ecologische schuld niet expliciet gebruikt wordt. Wanneer er met dit soort thema's geen rekening gehouden wordt en er alleen gefocust wordt op duurzaamheidsthema's in België en Europa, dan zal dat de illusie creëren dat "alles goed gaat". Ondertussen worden de negatieve gevolgen van Noordelijke productie- en consumptiepatronen afgewenteld op andere landen en toekomstige generaties. In dat opzicht zijn de inzichten en de methodologie die ontwikkeld zijn tijdens het project waarschijnlijk van ruimere relevantie dan enkel voor het strikte debat over ecologische schuld. Ze kunnen instrumenten zijn om het inzicht te verruimen in de betekenis van duurzaamheid, en meer in het bijzonder om de impact in kaart te brengen van fysisch-ecologische relaties tussen staten, nu, in het verleden en in de toekomst, zowel onder een business-as-usual beleid als onder gewijzigd beleid.

Om in het debat over ecologische schuld stappen vooruit te zetten, zullen allicht verschillende vormen van 'capaciteitsopbouw' noodzakelijk zijn: educatie bij het ruime publiek maar ook bij politici en het middenveld, intens lobbywerk op verschillende beleidsniveaus en het smeden van banden met sympathiserende politici, meer en grondiger wetenschappelijk onderzoek, netwerking tussen Noord en Zuid op het niveau van middenveld, politiek en wetenschap.

Introduction

The concept of ecological debt was coined by Southern NGO's at the beginning of the nineties. It usually refers to the ecological damage caused by industrialised countries in Southern countries and/or to the use of ecosystems and ecosystem services at the expense of Southern countries. Currently, several NGO networks from North and South are campaigning for the recognition of ecological debt.

On Belgian level, the concept made its way into the first Federal plan for Sustainable Development 2001-2004. In its paragraph 582 – part of the chapter on international cooperation – the Plan states, in one sentence, that "Belgium will study the concept of ecological debt and its practical applicability in policy." Between July 2003 and June 2004, several departments of Ghent University (the Centre for Sustainable Development/CDO, the Department of International Public Law, the Department of Plant Production) in collaboration with the NGO Flemish Platform for Sustainable Development (VODO), carried out a research project on ecological debt. This text is the scientific report of that project.

Objectives of the project

The aim of the project was to clarify the concept of ecological debt (state of affairs, definition, methodology, frame of reference) and to study its relevance and applicability in Belgian and international policy. The project was financed within the so-called Policy Preparation Research Program of the VLIR. The general objectives of this program are (1) formulation of policy relevant advice for the Belgian international cooperation and North-South policy and (2) development of expertise within Belgian universities on themes such as sustainable development, poverty alleviation and political, economic, social and cultural dimensions of development.

Within this general context, the project aimed at:

1. clarifying the concept of ecological debt. Important research questions were:
    - Definition of the concept 'ecological debt': what is included and what is not? Is ecological debt defined in monetary terms or in energy and material flows? What is the time perspective and starting point for analysis? What is the geographical perspective? What are advantages and disadvantages of quantifying ecological debt?
    - Methodology: which kind of methodology might be used when quantifying ecological debt? In what way can it be (further) developed?
    - Frame of reference: which different fields of science, policy and activism give the concept its foundation? E.g. ecological economics, environmental justice, environmental space and measures of physical flows, human rights etc.
2. studying its relevance and applicability in (Belgian) policy. The research focused on one policy domain and two policy themes:
    - policy themes are 'climate change' and 'food supply': is it possible to calculate ecological debts for these themes? What are mechanisms at work? What is needed to avoid future debts?
    - The policy domain is 'multilateral environmental agreements': in what way can ecological debt be integrated these international agreements? What are obstacles in the present context? What kind of solutions might be found?

It is important to realise that the research project focuses on the ecological debt of *countries*[1] and the consequences of this debt, such as the policy consequences on national level or in international negotiations. The question of ecological debt of e.g. companies is not treated, although it is touched upon a few times.

Methodology

The research was divided into a core research and a modular research. The core research focused on the clarification of the concept in general terms. The modular research was subdivided in three parts: energy and climate change, agriculture and food supply, multilateral environmental agreements (MEA's). The core research started in July 2003; the modules energy/climate and agriculture/food supply started in November 2003; the module MEA's started in January 2004. The project ended on 30 June 2004.

The project was coached by a follow-up committee ('begeleidingscomité') and an international reading committee. The follow-up committee consisted of representatives from government, administration, stakeholders (NGO's, labour unions, business, academics). An international reading committee of experts who contributed to the debate during previous years, was invited to give comments on draft papers and interim results.

On 18 May 2004, an international conference was organised in Brussels to discuss the main results of the project.

Structure of the report

The report consists of five parts. In the first part, the results of the core research are presented, with attention for the current state of affairs of the discussion, definitions problems, a methodology for calculating ecological debt and a frame of reference for interpreting the meaning of the concept. Part 2 presents the results of the research on the link between ecological debt and multilateral environmental agreements. It discusses the difficulties for introducing the concept in international law and possible solutions for these difficulties. Part 3 and 4 try to calculate the ecological debt of Belgium for two policy themes: first energy use and climate change, second agriculture and food supply. Finally, part 5 discusses some policy implications and draws up final conclusions.

Research group

- Centre for Sustainable Development – Ghent University: Prof Bernard Mazijn, Erik Paredis, Gert Goeminne
- Department of International Public Law – Ghent University: Prof Frank Maes, Jesse Lambrecht
- Department of Plant Production – Ghent University: Prof Patrick Van Damme, Wouter Vanhove
- Flemish Platform on Sustainable Development: Leida Rijnhout, Geert Fremout

[1] In this sense it is comparable with the ecological footprint or the environmental space of nations.

Project coordination and contact:
Erik Paredis
Centre for Sustainable Development – Ghent University
Poel 16
B – 9000 Gent
Belgium
Tel. 0032-9-264.82.08
Fax 0032-9-264.83.90
Erik.Paredis@UGent.be
http://cdonet.UGent.be

Corresponding authors for the different parts of the report:
- Core research: Erik Paredis, Erik.Paredis@UGent.be
- Module MEA's: Jesse Lambrecht, Jesse.Lambrecht@UGent.be
- Module energy/climate change: Gert Goeminne, Gert.Goeminne@UGent.be
- Module agriculture/food supply: Wouter Vanhove, Wouter.Vanhove@UGent.be

Part 1. Results of the core research: state of affairs, definition, methodology, frame of reference

Part 1 of this research report gives an overview of the results of the core research. The main goals of the core research were to clarify the meaning of ecological debt (definition, methodology, frame of reference) and to study, in general terms, its implications for international policy. In 1.1. the history and development of the concept is presented. The current state of affairs in the fields of definition, methodology for calculation and solutions for ecological debt are discussed in 1.2. Particular attention is paid to previous scientific research. Paragraph 1.3. introduces the methodology which was followed to formulate a definition capable of integrating concerns related to the content of the concept with language acceptable in international negotiations. Next, in 1.4. different methodologies are presented for calculating ecological debt. Paragraph 1.5. sketches a broader framework, necessary for understanding the new and different perspectives on sustainability brought about by ecological debt. In 1.6. conclusions are drawn. The research on policy implications is treated in part 5 of the report.

1.1. On the history of ecological debt: 'organic growth' of the concept

From a historical point of view, the concept of ecological debt must be seen as a counterargument to the financial debt weighing upon a lot of developing countries. The unofficial history of ecological debt traces its origins back to the beginning of the nineties and publications of the Chilean NGO Instituto de Ecologia Politica (IEP) (Robleto and Marcelo 1992). The IEP presented the concept in the context of ozone depletion where they concentrated on the costs related to the resulting health problems (skin diseases and cancers) in e.g. Southern Chili. In 1992, the concept made its way into the Debt Treaty, one of the alternative treaties formulated by NGOs and grassroots groups during the UNCED conference. The Debt Treaty states that "the foreign debt is the most recent mechanism of the exploitation of Southern peoples and the environment by the North". This is followed by another concern, i.e. "…the existence of a planetary ecological debt of the North; this is essentially constituted by economic and trade relations based on the indiscriminate exploitation of resources, and its ecological impacts, including global environmental deterioration, most of which is the responsibility of the North…". One of the pledges in this treaty is to "work for the recognition and compensation of the planetary ecological debt of the North with respect to the South" (paragraph 16) and "Put pressure on international organizations for the establishment, by the end of 1995, of a system of accounting of planet Earth in order to quantify the cumulative debt of the Northern countries which results from the resources they have levied and the destruction and waste produced in the course of the last 500 years" (paragraph 32).

From 1997 onwards, several NGO and NGO networks have picked up the concept and started campaigning with it. Acción Ecológica in Ecuador has played a key role in organising the

movement of Southern peoples through the organisation of workshops and the publishing of materials on the ecological debt, usually in the context of campaigns against the external debt. Acción Ecológica has been one of the chief organisers of the broader campaign on ecological debt, establishing links with other movements. At the South-South Summit of Jubilee South, a grouping of Southern movements demanded the cancellation of the illegitimate financial debt. In Johannesburg in November 1999 Acción Ecológica presented a statement entitled 'No More Plunder, They Owe Us the Ecological Debt!" (Acción Ecológica, 1999). In the same year, during the annual assembly of Friends of the Earth International in Quito, it was decided to launch a campaign on ecological debt. Joint efforts by Friends of the Earth International and Acción Ecológica led in 2000 to the launch of the Southern Peoples' Ecological Debt Creditors Alliance (SPEDCA). The objectives of SPEDCA are threefold. First of all, SPEDCA asks for an "international recognition of the ecological debt, historical and current". Secondly, they want a "recognition of the illegitimacy of external debt as made evident by ecological debt". Thirdly, they formulate a manifold of demands aimed at reparation for the historical ecological debt and at avoiding ecological debt from increasing in the future.

Currently, several NGO networks have adopted ecological debt as their main campaigning theme. The most important are SPEDCA, which groups NGOs from Southern countries (the creditors), the European Network for the Recognition of the Ecological Debt (ENRED), which groups European NGOs and individuals (the European debtors), and Justicia Ambiental, Deuda Ecológica y Sustentabilidad (JADES), which is a discussion group between creditors and debtors.

It is interesting to compare the development of the concept of ecological debt with that of other popular concepts in sustainability discourse such as ecological footprints and environmental space. The difference between ecological debt on the one hand and ecological footprint and environmental space on the other hand, can be characterized as a 'bottom-up' versus a 'top-down' development. Ecological footprints and environmental space have been developed by scientists and have then been enthusiastically adopted by NGOs, and to some extent been translated into political debate. In the case of ecological footprint, the scientists William Rees and Mathias Wackernagel (1992, 1996) laid the foundations for the concept and its methodology, after which a myriad of NGOs has started working with the concept since the second half of the nineties. This has spurred further development and refinement of the concept and its methodology. In the case of environmental space, the foundations have been laid by Hans Opschoor (1987, 1989). First Milieudefensie (the Dutch branch of Friends of the Earth) and later Friends of the Earth Europe have popularised the concept, with scientific support from researchers of the Wuppertal Institut, who have further developed and refined the concept and its methodology. Both ecological footprint and environmental space are well established concepts by now, and although further refinements are possible, it is fairly easy to grasp what exactly is meant by both concepts and how they can be measured.

With ecological debt, the development of the concept has almost been the other way round. The concept has primarily been developed through NGO campaigning. Systematic scientific support for these campaigns has almost been non-existing. The little scientific work which is available (Azar and Holmberg 1995, Jenkins 1996, Smith 1996), has to the best of our knowledge, not been used. The only exception is the work of the Spanish ecological economist Joan Martinez-Alier, who has published several times on the concept (e.g. Martinez-Alier 2002) and who also lends his personal support to the campaigns. Martinez-Alier has concentrated in particular on mechanisms underlying the concept (such as ecological unequal exchange) and less on a methodology for calculation. Building on

suggestions from Martinez-Alier, Mariano Torras tries calculating ecological debt in a recent article in *World Development* (December 2003) and links it to external debt relief.

The picture which emerges from this description is one of an 'organic growth' of the concept ecological debt: through discussions and exchanges within the NGO networks, the concept is formulated and reformulated; new interpretations or applications are developed. A notable recent development seems to be a shift in accent from 'ecological debt of countries' to 'ecological debt of companies'. While ecological debt was in origin usually defined as a problem of industrialised versus developing countries, case studies often focus on ecological debt caused by corporations / multinationals. An example are the case studies discussed in the recent book from SPEDCA (SPEDCA 2003) and case studies presented during workshops at the World Social Forum 2004 in Mumbai[2]. Suggestions have been made to label this distinction as 'public ecological debt' versus 'private ecological debt'[3] but until now, there has been no systematic treatment of the difference between the two.

1.2. Current state of affairs: different views and methodologies

This paragraph tries to give an overview of the present discourse on ecological debt. In 1.2.1. to 1.2.3. we concentrate on the ideas and arguments developed within the NGO campaigns. In 1.2.4. we present an in-depth discussion of the available scientific articles.

1.2.1. Different definitions

At the moment, there does not seem to be one universally used definition. Several definitions of ecological debt are used alongside each other. Definitions change over time; some are more far reaching than others. A few examples. Acción Ecológica (1999) defines ecological debt as

> "the responsibility that the industrialised countries have for the gradual destruction of the planet caused by their production and consumption patterns. Patterns characteristic of the present development model that is being spread throughout the world and which is threatening local economies. The Ecological Debt includes the illegitimate appropriation of the atmosphere and of the absorption capacity of the planet. The Ecological Debt is the obligation, and responsibility that the industrialised countries of the North have with the countries of the Third World, for the looting and use of natural goods: petroleum, minerals, forests, biodiversity, and marine resources; to the cost of human energy of their people and of the destruction, devastation, and contamination of their natural heritage and sources of sustenance." (Acción Ecológica 1999, 1)

In fact, the text contains two definitions of ecological debt. In the first sentence, the cause of debt are industrialised countries with their consumption and production patterns, the victim

[2] 18 January 2004, seminar 'Ecological Debt Creditors'; 19 January 2004, seminar 'External debt; ecological debt and trade'

[3] Email exchange on the JADES mailing list; suggestion made by Martinez-Alier 22 december 2003. Referring to court cases against multinationals under the US Alien Tort Claims Act (ATCA), Martinez-Alier states that these cases are examples of "what we call sometimes the 'private' ecological debt by corporations, such as Union Carbide because of Bhopal, the Texaco case in Ecuador, Cape in South Africa, Freeport McMoRan in West Papua, the Southern Peru Copper Corporation in Peru (…) There is also the so-called 'public' ecological debt, for instance the Carbon Debt. This issue in itself (private/public Ecological Debt) is of interest."

(or 'creditor') is the planet. In the third sentence, the cause is still the North, but the creditor is the Third World. The mechanism by which the debt is created is more defined, namely the looting and use of natural resources.

More recent definitions show some new accents, but with the same double definition. During the Indonesian Peoples' Forum (Bali 2002), Aurora Donoso of Acción Ecológica states that

> "the ecological debt is the responsibility that industrialised countries, their institutions, banks, political economic and corporations have for the gradual appropriation and control of world natural resources and the destruction of the planet caused by their patterns of production and consumption, typical of the development model which they hope to globalize, and which threatens local sustainability and perdurability. The Ecological debt also includes the appropriation of the planet's absorption capacity and of the atmosphere, by polluting it with the emission of greenhouse effect gases"

The problem of destruction of the planet is enlarged to the appropriation and control over resources. The actors are specified, that is the industrialised countries, institutions, banks, political and economic elite[4], corporations. In the next paragraph in Donoso's text, she enlarges the debtors with Northern allies in Southern countries, and the creditors are countries "and peoples" of the Third World. The consequences of ecological debt are extended with displacement of peoples and destruction of culture.

> "The Ecological Debt is the obligation and responsibility that Northern, industrialized countries and their institutions and their allies in the Southern countries have, to the countries and peoples of the Third World, for the looting and use of its natural goods; at the cost of the human energy, displacement of its peoples and for the destruction, devastation, and pollution of its natural heritage, culture, and sources of sustenance." (Donosa 2002, 1-2)

In most texts, a variant of the definition with Third World countries as creditors is used. E.g. Martinez-Alier, Simms and Rijnhout state that

> "ecological debts may be very broadly defined. They include pollution, 'theft' of resources and disproportionate use of the environment (…) Ecological debt is the debt accumulated by Northern, industrialised countries towards Third World countries on account of resource plundering, unfair trade, environmental damage and the free occupation of environmental space to deposit waste. A particular and interesting aspect of it is carbon debt, as a consequence of greenhouse gas emissions" (2002, 1)

Christian Aid defines carbon debt as follows: "Those countries that are using more than their fair share of the climate, and adding more to the damaging effects of global warming, are running up a debt to those countries that are using less than their fair allocation." (1999, 5-6)

According to Acción Ecológica, the ecological debt began in the colonial period and still increases by the following mechanisms (cited from Donoso 2002, 2):

- the extraction of natural goods, such as petroleum, minerals, marine, forest and genetic goods in order to support Northern industry, which is destroying peoples' ability to survive. And trade is also ecologically unbalanced, as these goods are exploited and

[4] The text reads literally "political economic and corporations", which is probably a writing mistake

exported without taking responsibility for the social, cultural and environmental damage involved.

- The intellectual appropriation and usufruct of ancestral knowledge related to seeds, the use of medicinal plants and other knowledge on which biotechnology and modern agro-industry is based, and for whose products we have to pay a premium
- The appropriation, use and degradation of the best lands, of the water and air, of human energy, in order to establish export cultures to support consumerism in the North, putting at risk the food and cultural sovereignty of local and national communities
- The illegitimate appropriation of the atmosphere, and of the carbon absorption of oceans and vegetation, by polluting the atmosphere with disproportionate carbon emissions from industrialized countries, which are the main cause of the greenhouse effect and of the degradation of the ozone layer
- The production of chemical, biological, toxic and nuclear weapons, substances and residues that are sold and duped in Third World countries.

These are some examples out of the NGO campaigns and awareness raising. The picture becomes more complicated when the few available scientific articles on ecological debt are taken into account (see 1.2.4.).

1.2.2. Methodologies and quantification

The 'Strategies for Action' proposed by the Debt Treaty mentioned above (Global Forum, 1992) called for "pressure on international organizations for the establishment, by the end of 1995, of a system of accounting of planet Earth in order to quantify the cumulative debt of the Northern countries which results from the resources they have levied and the destruction and waste produced in the course of the last 500 years."

To the best of our knowledge no official international organisation ever took up this challenge, neither does there exist a uniform methodology towards quantifying ecological debt. In the NGO campaigns, a few attempts have been done to calculate the 'carbon debt'. In these cases, quantification of ecological debt is nearly always understood as monetization of nature's services, i.e. expressing the ecological debt in money terms.

All calculations performed so far start from the assumption that contraction of carbon emissions should aim at bringing emissions down to a sustainable per capita level. A widely quoted sustainable level is that communicated by the Intergovernmental Panel on Climate Change, i.e. 60% below actual 1990 emissions (IPCC, 1990). Based on this target for climate stabilisation, a sustainable per capita allowance would be around 0.4 tons of carbon per year[5]. Those countries that are using more than this fair share, amongst them all industrialised countries, add more to the damaging effects of global warming and are therefore running up a debt to those countries that are using less than their fair allocation. As there is a general agreement on the carbon emission data as collected by the UN Framework Convention on Climate Change it is straightforward to quantify the carbon debt of nations in terms of tons of carbon. Comparing actual G7 emission data for 1990 and 1996 results in an annual carbon debt (calculated for the year 1996) of 1547 Mtons of carbon. To get an idea of the magnitude

[5] Emissions are generally expressed in tons of carbon or tons of CO_2. Chemistry tells us that 1 mole CO_2 weighs 44g and contains 1 mole of carbon weighing 12g. From this a conversion factor of (1 ton carbon/3.67 ton CO_2) can be derived.

of the carbon debt expressed in monetary values a price has to be given for carbon. This creates practical and theoretical problems as there is no current market for carbon.

A first indication could be made up from the market price of oil, as Andrew Simms, Nick Robins and Aubrey Meyer suggest in the 1999 study *Who owes who'* published by Christian Aid (1999). An average price of 25 US$ per barrel crude oil was noted on the oil market in 2002. Approximately seven barrels of oil make up one ton of carbon which would give a price of about 175US$ per ton of carbon. The authors stress that this is only a face value put on fuel by the laws of supply and demand; there is no way of accounting for the social and environmental damage resulting from the pollution, nor does it value the cost to future generations of our exhausting a finite resource and the physical damage from climate change.

The same study makes another price estimate using their own measure of "efficiency" based on a fixed ratio of GDP measured in dollars to carbon emissions measured in tons. Some economists (e.g. Joan Martinez-Alier) dispute the relevance of this methodology on the grounds that it assumes a fixed ratio of carbon emissions to GDP when in fact some GDP may correspond to activities that produce no carbon. In 1990, the year of the first IPCC report, for every ton of carbon emission produced around 3000 US$ was generated. This suggests that the annual carbon debt owed by the G7 to the South "in economic efficiency terms" amounts to 4.6 trillion US$. Christian Aid itself reports a number of 13 trillion US$, but it does not indicate how it reached this result.

In his study *Ecological Debt: South Tells North 'Time to Pay Up* (Ecumenical Coalition for Economic Justice, 2000) John Dillon calculates a range of estimates for the financial compensation due to carbon creditors based on three possible prices: US$10, US$12.50 and US$20 per ton of carbon; these represent a range of actual estimates for the price of emission rights per ton of carbon[6]. These calculations yield estimates of the annual carbon debt owed by G7 countries of between US$15.5 and US$30.9 billion. Extending the calculation to include all Northern countries yields an estimate of annual carbon debt of between US$30 billion and US$59 billion.

It may be clear that these numbers are only a rough estimate of the magnitude of the carbon debt. Note that the carbon debt, calculated in any of these ways, is quantified according to the unpaid abatement cost. An alternative method could be to count the damages that will be done by not reducing emissions, but here we would need to put prices on human lives, unknown biodiversity and other losses, discounting them (or not) at present values (see also the paragraph on monetary valuation 1.4.5.).

John Dillon (2001) further states that while there is general agreement in the campaigns that the ecological debt outweighs the financial debt by far, there are some disagreements concerning how the ecological debt might be quantified and whether it could ever be collected. He states that no quantification can ever be comprehensive and he mentions the need for a quantification of ecological debt "not just in monetary terms alone (…) Efforts to quantify the ecological debt in monetary terms can assist campaigning as long as we insist that the ecological debt issue must never be reduced to demands for monetary compensation alone". He refers to the possibility of using the concept of ecological footprints, elaborated by Wackernagel and Rees, for calculating ecological debt.

[6] see e.g. http://www.nccp.ca/NCCP/national_stakeholders/pdf/price_of_carbon_e.pdf

It is indeed clear that positions on quantification and desirability of quantification have not crystallised out. In a proposal for the 'campaign for the recognition and claim for the ecological debt' Aurora Donoso from Acción Ecológica states explicitly that the campaign "does not seek:

- to put a price on nature
- nor to place 'environmental services' on the market
- nor to put a price on the right to pollute
- nor does it seek to promote 'debt for nature swaps' because the foreign debt is illegitimate and has already been paid."

Duncan McLaren (2003) puts it this way: "theoretically it may be possible to put a money value on the ecological debt – by calculating the value of the environmental and social externalities associated with historic resource extraction and adding an estimated value for the share of global pollution problems borne by poor countries as the result of higher consumption levels in rich ones. In practice such an approach would suffer from the same shortcomings as efforts to value the external costs associated with climate change and most campaigners *sensibly* resist it" (our italics).

1.2.3. Solutions and actions to reduce ecological debt

What do campaigners say on what should be done to reduce the ecological debt? There is a consensus that the ecological debt should at least be *recognised*, and that, as a counterpart, the external debt should be recognized as illegitimate. This seems to imply an unconditional cancellation of external debts, although this is usually not made explicit. Besides, there are no indications of what procedures will or should be followed to establish the recognition and the links between the two recognitions.

It is surprising that, beyond the cancellation of external debt, explicit claims for repayment of historical ecological debts are seldom made. Most claims focus on restructuring international mechanisms and production and consumption patterns in industrialised countries in order to *avoid new ecological debts*. Beyond recognition, SPEDCA makes two demands from Northern countries with a historical perspective:

- Repatriate plundered cultural and natural heritage, including genetic materials
- Restore those natural areas damaged by mining and monoculture agriculture

Their other three demands are future facing:

- Reduce carbon emissions and destructive competition
- Eliminate all conventional, nuclear, chemical and biological weapons, products and toxic substances that threaten the life of this planet
- Recognise and give rights to the increasing migration of poor people displaced by the neoliberal model which promotes external and ecological debt.

Dillon cites a Brazilian study which states that payment of ecological debt should be used for environmental restoration and implementation of an environmentally sustainable and socially equitable development. Mechanisms for resource transfer include "money, technologies, knowledge, information etc; always under strong social control and for the benefit primarily of those social sectors most directly affected by the environmental damage that incurred the debt. But we insist that one cannot reduce the ecological debt to its economic dimension. It is essentially a political and historical debt. Therefore its treatment must be political. Thus when

we demand the payment of this debt it is from a political perspective that demands real changes in the model of development." (Leroy, cited in Dillon 2000, 11)

The political act of international recognition of ecological debt (and illegitimate external debt) seems to be the crucial point here. The hope is that this act will be a lever for further negotiations. This is referred to by Simms as well when he states that climate change in combination with ecological debt "creates an entirely new context for dialogue between nations. As poor countries become increasingly aware of the issue they will question the right by which rich countries, and their financial institutions, exert authority over them (…) They will also challenge the continuing status quo of unequal global wealth distribution, powered by unequal use of our fossil fuel inheritance (…) Over time, the equal distribution of property rights in the air above our heads will mean the biggest economic and geo-political realignment of recent history." (2001, 2). Apart from recognition of ecological debt, Simms pleads for an internationally agreed method of measuring it (initially centred on climate change) and an international commission to investigate the implications of ecological debt for international relations (e.g. for debt, trade, aid).

As stated, most proposals concentrate on avoidance of future debts, in particular on avoidance of carbon debt. Simms and Greenhill (2002, 11) propose the following framework for ecological debt in connection with global warming (almost identical to the proposals in Martinez-Alier, Simms and Rijnhout 2002):

- Calculate the costs – on a regional and national basis – for implementing adaptation strategies to climate change
- Fulfil existing commitments entered into under the UNFCCC and Kyoto Protocol. Without this, future negotiations and target-setting would be in great jeopardy
- Reversing subsidies in industrialised countries from fossil fuels and fossil fuel-based activities towards development renewable energy technologies, at home and in partnership with poor countries
- US compliance by pursuing all available strategies, including political pressure, dialogue and, "if necessary", legal action such as border tax adjustments on US goods (because not reducing emissions is a hidden subsidy for US manufacturers) and tort actions by developing countries suffering the adverse effects of global warming
- Setting a 'contraction and convergence' framework for the future based on tradable, equal per capita entitlements to carbon emissions

Clearly different positions are visible on themes such as trade. In an article by Acción Ecológica entitled 'Trade, climate change and the ecological debt' (Acción Ecologica, 2000) it is recommended that "all processes promoting trade expansion should be brought to an immediate halt" and "Southern countries must take the lead in ensuring sustainability and climate stability… and embark on a policy of non-cooperation with the present economic model"; they "must prepare other strategies to improve the welfare of their people… and withdraw from a trade/export based economic system…". This contrasts with e.g. the Memorandum for the WSSD in Johannesburg, prepared by the Belgian NGO VODO where it is stated that "the WTO has to be reformed in order to give more importance to the interests of developing countries", a reform which should be based on an impact study of existing trade regulations. VODO pleads for clear arrangements on the relations between WTO and environment and development agreements (such as UNFCCC), codes of conduct for multinationals, a global plan on commodities and more participation for developing countries and ngo's during trade negotiations.

1.2.4. Previous scientific research: discussion of relevant articles

In this paragraph, the few available scientific articles are discussed in some detail. We limit ourselves to what might be called 'direct literature sources', which explicitly study ecological debt (although sometimes different terminology is used). In paragraph 1.5. of this report, it will become clear that further development of the concept of ecological debt will also depend on 'indirect literature', i.e. insights developed in other scientific fields (ecological economics, biophysical accounting, international law…). The articles discussed here shed more light on the problem of defining exactly what 'ecological debt' is and in how it can be measured. It is important to mention that different terminology and methodologies are used and that cross-references are limited.

1.2.4.1. Azar and Holmberg (1995): generational and foreign environmental debt

Azar and Holmberg (1995) use the term 'environmental debt' for the monetary cost associated with environmental damage. They distinguish between global generational environmental debt, national generational environmental debt and foreign environmental debt. *Global generational* environmental debt is a measure for the total amount of environmental damage that past and present generations have caused, but that will affect future generations. *National generational* environmental debt is the debt a specific nation has to future generations (independent of the country they live in). *Foreign* environmental debt is the environmental debt which a specific nation has to other nations. All forms of debt are measured in monetary terms.

What Azar and Holmberg call foreign environmental debt is in fact what is usually meant by ecological debt in the present campaigns. The distinction between generational and foreign aspects of environmental debt is not made in the present campaigns. But it can be argued that when (Northern) countries are damaging and over-using global ecosystems (such as the climate system), part of the debt resulting from this damage and over-use is due to the South, while another part of it is a debt towards future generations (see further on 1.3.4.4. and 3.4.2.). What Azar and Holmberg call global GED is an aggregation of all environmental debt future generations will be faced with, but this does not teach us anything about which countries are most responsible for this debt.

Azar and Holmberg make another interesting distinction, which has consequences for the operationalisation of environmental/ecological debt. They state that there are four ways of delimiting calculations of national generational environmental debt[7] of a certain country (e.g. Belgium) (ibid., 13)

- The effect-related method: calculates negative environmental impacts on Belgian territory, independent of the nationalities of those who caused the impacts and where the activities that caused the negative impacts took place
- The activity-related method: calculates negative effects on the global ecosystems (Belgian ecosystems included) following activities within Belgian territory independent of the nationality of those who caused the activities
- The consumption-related method: calculating all the environmental impacts that follow from consumption by Belgian citizens, as well as the production that is necessary for this

[7] In our opinion, similar distinctions can be made for calculating foreign environmental debt

consumption, independent of where the consumption, the production and the impacts take place

- The production-related method: calculating all the impacts resulting from production in Belgian-owned factories and the consumption of the goods that are produced in these factories, independent of where production, the following consumption and the impacts take place

According to the authors, the consumption-related method gives the most appropriate measure of a national generational environmental debt, "since those who finally utilise a good or service also should pay for its negative effects" (ibid.), but they think the method is too complicated due to high dependency on detailed statistics. Therefore, they use the activity-related method. Figure 2 illustrates the generational and foreign environmental debt for Belgium, according to the interpretation of Azar and Holmberg.

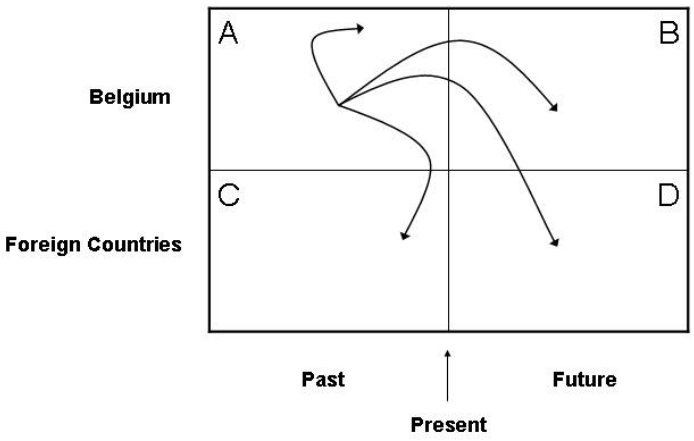


Figure 2. The Belgium foreign and generational environmental debt for a specific activity. The Belgian generational environmental debt is given by the damage in the areas B and D. The Belgian foreign environmental debt is given by the damage in areas C and D (adapted from Azar and Holmberg 1995).

Some comments on this distinction in methods.

First, the effect-related method is in fact the creditor point of view on ecological/environmental debt. It would be better to speak of 'ecological debt *to* country A' instead of 'ecological debt *of* country A'. E.g. the ecological debt *to* Ecuador are the "negative environmental impacts on Ecuadorian territory, independent of the nationalities of those who caused the impacts and where the activities that caused the negative impacts took place". What should be added to this calculation is the part of the damage to ecosystems beyond national jurisdiction that should be assigned to Ecuador.

Second, the other distinctions made resemble the distinctions which in MFA are made between the residence and territory principle for calculations (and which also account for the difference between GNP and GDP). There is further an application of the distinction between a consumption and production-oriented approach for calculations of environmental pressures. These distinctions are certainly useful when trying to operationalise ecological debt.

For their calculation of generational environmental debt, Azar and Holmberg follow a procedure from neoclassical environmental economics. They state that the present generation can either restore the damage or compensate future generations for the damage which we have caused. The marginal benefit of restoration (or damage avoided) decreases and the marginal cost of restoration increases with the degree of restoration. Within this way of thinking, present generations should restore a specific damage until the marginal benefit of restoration equals the marginal cost of restoration. In figure 3 the GED for each specific damage is equal to the sum of the cost of restoration (area A) and the cost of the remaining damage (area B). Total GED is given by adding GED for all specific damages (ibid., 9).

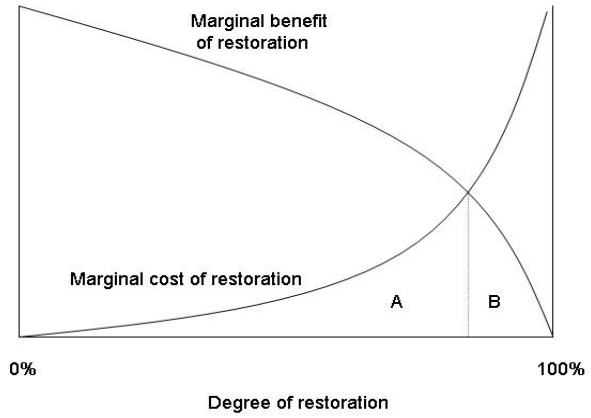


Figure 3. GED for specific damage (Azar and Holmberg 1995)

Azar and Holmberg estimate global GED for CO_2 emissions at 10.000 billion US dollars. Swedish accumulated CO_2 emissions are approximately 0,5% of global accumulated emissions; Swedish GED for CO_2 emissions is estimated at 60 billon US dollars. This monetary calculation of environmental debt typically raises a lot of questions of valuation which they are aware of and mention: the implicit assumption of full substitutability between natural capital and human-made capital, the choice of the discount rate etcetera. A sensitivity analysis of their estimates results in a lower range value for GED equal to zero or even slightly negative (which implies a positive transfer to future generations!) and an upper limit value of 3.1×10^{13} US dollars. "Due to the complexity in causal chains and delay mechanisms it is extremely difficult to give a narrow uncertainty range" (ibid., 18). In the final analysis, their main reason "for making monetary estimates of GED in addition to physical indicators, even if the uncertainty range is wide, is that monetary measures have a strong influence on policy makers" (ibid.). This is exactly the same argument Martinez-Alier makes (2002, 228; see also 1.2.4.4.) and it is what Common (2003, 2, 4) calls "the cultural soup argument. In modern societies, on this argument, politicians and those who vote for them will only give proper attention to environmental considerations if they are stated in monetary terms". He states that in this argument, the exactness of the figure reached is less important, "what seems to be required is a number that is sufficiently big to do the job required of it, to capture attention, to make people realise that 'the environment' is important." Even though one might ask whether the argument is completely correct – political and public discussions on Kyoto use reductions in CO_2-emissions as argument (and the costs associated with reductions) – it is important not to ignore the argument.

To conclude, what do we learn from Azar and Holmberg (1995) for the current research project?

1. the distinction made between national GED and foreign environmental debt: definitions and discussions of ecological debt used in NGO campaigns state that all ecological debt is owned to Southern countries. They do not take into account that part of the ecological debt may be owed to future generations. Although the distinction is made in this article, there are no indications as to how it should be operationalised.
2. all nations can in principle be debtor to all other nations and generations; in practice, industrialised countries will probably be the debtors, but there is no a priori reason why industrialised country A cannot be indebted to industrialised country B, or why developing country X cannot be indebted to developing country Y.
3. it is necessary to specify how we delimit our calculations: do we use a resident or territorial approach? Do we use a production or consumption approach?
4. the authors use a monetary interpretation of environmental debt: this typically raises difficult questions of valuation, but monetary valuation has the merit that it easily captures political and public attention.

1.2.4.2. *Jenkins (1996): ecological debt between countries*

Jenkins states that the current economic development path is unsustainable and undemocratic. It promotes economic growth for developed and developing countries as the way to welfare and to improvement of the environment, but it ignores the problem of scale and carries the implication and the promise that the rates of resource consumption typical in developed countries can be achieved globally (Jenkins 1996, 235). Jenkins promotes an ecological economics view of development which recognizes that the developed countries growth path cannot be continued and imitated because it is inequitable and ecologically dangerous. "In ecological terms, 'developed' countries are in debt to 'developing' countries, largely because of the way in which economic growth is measured gross of externalised social and environmental costs" (ibid., 232). The strategy Jenkins advocates is one of reduction in resource consumption in developed countries in order to provide more access to the global commons for the developing countries to institute their own development. This "alternative development model" includes the recognition of ecological debt. It has two stages (ibid., 236): first recognise, calculate and liquidate once-and-for-all the ecological debt; second, commit economies unconditionally to sustainable development. He then goes on to illustrate what he means by ecological debt, using the case of global warming.

Jenkins first calculates the efficiency of the current global economy which is given by:

GDP per capita / equivalent CO_2 emissions per capita (1)

Based on IPCC recommendations – the necessity of an immediate 60% reduction in global greenhouse gases – he then calculates which efficiency gains are needed to reach a sustainable level of consumption. This gives him sustainable emissions in CO_2 equivalents[8] of 0,318 tonnes per capita, i.e. emissions which could be applied worldwide, with each country effectively given an emission allowance according to its population. "Such allowances could then be compared to actual CO_2 equivalent emissions, with countries exceeding their allowances becoming 'debtors' and countries falling short of their allowances becoming 'creditors'" (ibid., 236). Jenkins states that "for many purposes, ecological debt is best interpreted and understood in non-monetary terms" (237), but he does not specify which purposes he means.

[8] CO_2 equivalents = industrial CO_2 emissions plus the equivalent CO_2 heating effect of industrial CH_4 emission and CFC use.

He then adds that monetary valuation "may provide a useful backdrop against which to view global environmental initiatives, such as the World Bank's Global Environmental Facility for global warming and biodiversity projects." Jenkins' monetary valuation is based on his 'global average efficiency rate' (equation 1), which he calculates at $ 6077 per tonne equivalent CO_2 emission. For his sample of countries[9], debtor countries annually owe $ 9973 billion to creditor countries, divided between $ 9082 bn from unsustainable activity and $ 892 bn used up from what actually are creditor countries' allowances. Creditor countries can increase their CO_2 emissions by 23% without breaching their sustainability allowances.

One of Jenkins' important conclusions is that, although his quantification is only illustrative and takes only part of the ecological debt into account, "the general picture is clear: it is one of serious distortions in the global political economy, with the model showing where the unsustainability of the present economic order is to be found and (approximately) in what proportion" (237). Remarkable is that he founds his calculations on just one year.

To conclude, what do we learn from Jenkins (1995) for the current research project?

1. he uses a per capita approach because he thinks it is the most appropriate approach in the context of global income inequality and finiteness of environmental resources. It provides an opportunity of combining equity with carrying capacity, and is in this aspect distinct from classical economic approaches
2. recognition, calculation and liquidation of ecological debt is the first stage in his alternative development model
3. he thinks ecological debt is best interpreted and understood in physical terms, but does not really give arguments
4. only countries who do not exceed their emission allowances qualify as creditors; again, there is no a priori reason why the dividing line should be North-South (although in practice…)

***1.2.4.3**. Smith (1991 and 1996): the natural debt*

The question 'who is obliged to finance future emission reductions' is the central starting point in Smith's paper. He starts by stating that responsibility is a useful but incomplete measure of a country's accountability for financing emissions reductions. A negotiated solution must also consider a country's available resources with which to pay. The overall obligation to pay, according to Smith, thus addresses two issues, one ethical (responsibility) and one practical (capacity). The ethical issue is that those countries that have contributed most to the problem (and benefited thereby) should have some obligation to pay for its amelioration. The practical consideration is simply that a solution to the problem is more likely if those countries that have greater resources are willing to pay relatively more of the total cost.

Therefore, he argues to divide the question 'who pays' into two parts: (1) the 'ability to pay,' and (2) the 'responsibility to pay' and presents two indices, the Ability To Pay (ATP) and the RESPonsibility (RESP) index, as their respective measures.

[9] In fact, he only uses 16 countries from a range of levels of 'development', economic systems and geographical locations, which account for 59% of both world population and GDP.

The ATP index is based on some degree of national income. Smith prefers the Purchasing Power Parity (PPP, see Summers and Heston (1988)) statistics to GNP as the PPP corrects for some methodological problems with GNP arising from the presence of large informal sectors in some economies, the vagaries of fluctuating exchange rates, and from the differences in purchasing power. The ATP_c of a country c is then determined as

$$ATP_c = PPP_c - Pop_c.PPP_{threshold}$$

where PPP_c and Pop_c are total national income, measured as purchasing power, and population, respectively, and $PPP_{threshold}$ is some threshold income per capita, according to a threshold of basic need.

The most obvious measure of a nation's responsibility for the present situation is simply its current emissions. A problem with current emissions as a measure, however, is that it does not completely reflect physical reality. The extra greenhouse warming that occurs at any time is actually due to the cumulative amount of greenhouse gases remaining at that time, rather than to the emissions that year.

Therefore, Smith introduces the concept of 'natural debt' as the amount of greenhouse gases remaining in the atmosphere in any one year due to a nation's emissions. The total remaining today is however not equal to the total emitted from all past history, because earth's natural assimilative capacity removes CO_2 at a certain rate. Thus, the remaining fraction of emissions is the most accurate indication of natural debt because it is the best indicator of the resulting impact today. He uses the Siegenthaler formula (Siegenthaler, 1983) to calculate the remaining CO_2 in the atmosphere at a certain time after emissions. The natural debt, he argues, is built by borrowing assimilative capacity of the atmosphere from the future, through the release of greenhouse gases faster than they can be naturally removed. Just as with the national financial debt, which is built by borrowing financial resources from the future, borrowing on the natural debt, has allowed nations to build up their infrastructure and economic wealth faster than would have occurred otherwise. Therefore, as with the financial debt, it does not seem unfair to ask nations to pay off the natural debt in the same proportion as it was borrowed and that control of the natural debt would begin by first reducing the yearly borrowing. He also mentions that there are other important parts of a nation's natural debt besides greenhouse gases, like excess concentrations of pollutants in lakes, rives due to rates of pollutant emissions exceeding natural assimilative capacity, for example.

He further argues that responsibility is best judged on a per capita and not on a per nation basis because every human being has he same equal right to atmospheric resources. Otherwise, responsibility would be somehow a function of size, that if you are lucky enough to live in a small country you are not as responsible as someone living in a large country, even if your own personal emissions are the same. So, a national government should be held responsible for global warming according to the number of citizens and their per capita natural debts. To determine responsibility it is further necessary to choose a global threshold natural debt equivalent to a stable global CO_2 concentration. A number of ways to do this exist but Smith opts for a stable global CO_2 concentration of 350 ppm, or about the level in 1990 which comes down to a per capita global threshold natural debt of about 25 tonnes CO_2.

The responsibility index of a country c, $RESP_c$, is thus defined as

$$RESP_c = ND_c - Pop_c.ND_{threshold}$$

where ND_c and POP_c are a nation's natural debt, as described above, and population, respectively, and $ND_{threshold}$ is the per capita global threshold natural debt. Accounted over the 1950-1991 period Belgium has a natural debt of 82 tons per capita and a 0.99% share in the worldwide responsibility compared to e.g. 119 tons (41.8% responsibility) for the USA and 2.7 tons (0% responsibility) for India.

In an earlier paper Smith (Smith, 1991) tries to elaborate on a monetary valuation of that part of the natural debt related to carbon dioxide from fossil fuels. A value of US§ 20 per ton CO_2 is derived from the costs of planting enough forest to sequester a kilogram per year. He stresses that this cost is only approximate, but gives an idea of the magnitude of the natural debt.

By having a separate indicator for both issues, i.e. ability to pay and responsibility, he argues, international negotiations can proceed in an orderly way to trade one against the other to obtain the politically optimum mixture that becomes the obligation to pay. He also argues that this method could be adopted to allocate responsibility for whatever needs to be done by using indices that reflect an expectation that nations should pay back the debt in the same proportion as it was borrowed.

To conclude, what do we learn from Smith (Smith, 1991 and 1996) for the current research project:

1. He uses the concept of natural debt as a debt incurred by 'borrowing assimilative capacity from the future' (Smith, 1996) or by the 'consumption of environmental resources faster than they naturally regenerate' (Smith, 1991).
2. Allocating responsibility, with the natural debt as a measure, is best done on a per capita and not on a per nation basis, he argues, as 'every human being has the same equal right to atmosphere resources'.
3. Stating that the remaining fraction of emissions is the most accurate indication of the natural carbon debt because it is the best indicator of the resulting impact today, he explicitly interprets natural debt as being incurred when impact is caused.
4. He emphasizes the points of agreement between a nation's natural debt and its financial debt. Both have allowed the country to achieve its present economic status and therefore, as is the case with the financial debt, it seems fair to ask nations to pay off the natural debt in the same proportion as it was borrowed. Also, control of the natural debt would begin first by reducing the yearly borrowing; build-up of natural debt in the future should be avoided.
5. Smith's monetary valuation is only meant as an illustration of the financial magnitude of the natural debt. In reality monetary valuation would not be necessary as Smith believes that the decision on how much a country should do (and thus pay) to combat climate change should be negotiated based on both the 'ability to pay' and the 'responsibility' of a country.

1.2.4.4. *Martinez-Alier (2002): ecological debt as an economic concept*

The treatment of Martinez-Alier's arguments is based on his book *The Environmentalism of the Poor* (2002). Martinez-Alier states that the ecological debt is an economic concept which arises from two separate ecological distribution conflicts. Since he treats ecological debt as an economic concept, he expresses it in money terms, although he admits is it hard to quantify in money terms (Martinez-Alier 2002, 233). He further thinks this may raise objections because "it implies monetization of Nature's services. I confess, *mea culpa*. My excuse is that the language of chrematistics is well understood in the North" (ibid., 228).

According to Martinez-Alier, the first cause of ecological debt is ecologically unequal exchange, or the fact that exports of raw materials and other products from relatively poor countries are sold at prices which do not include compensation for local or global externalities (ibid., 213). Ecologically unequal exchange is responsible for the following components of ecological debt (ibid. 227-228) :

- The (unpaid) costs of reproduction or maintenance or sustainable management of the renewable resources which have been exported: for instance, the nutrients incorporated in agricultural products
- The costs of the future lack of availability of destroyed natural resources: for instance, the oil and minerals no longer available, or the biodiversity destroyed. This is a difficult figure to compute, for several reasons. Figures on the reserves, estimation of the possible technological obsolescence because of substitution, and a decision on the rate of discount are needed in the case of mineral oil. For biodiversity, knowledge of what is being destroyed would be needed.
- The compensation for, or the costs of reparation (unpaid) of the local damages produced by exports (for example the sulphur dioxide of copper smelters, the mine tailings, the harm to health of flower exports, the pollution of water by mercury in gold mining) or the present value of irreversible damage.
- The (unpaid) amount corresponding to the commercial use of information and knowledge on genetic resources, when they have been appropriated gratis (…). For agricultural genetic resources, the basis for such a claim already exists under the terminology of Farmers' Rights.

The second cause for ecological debt according to Martinez-Alier is the fact that rich countries make a disproportionate use of environmental space or services without payment, and even without recognition of other people's entitlements to such services (particularly, the disproportionate free use of carbon dioxide sinks and reservoirs) (ibid., 213). Lack of payment for environmental services and disproportionate use of environmental space are responsible for the following components of ecological debt (ibid., 228):

- The (unpaid) reparation costs or compensation for the impacts caused by imports of solid or liquid toxic waste
- The (unpaid) costs of free disposal of gas residues (carbon dioxide, CFC and so on), assuming equal rights to sinks and reservoirs

In a discussion on climate change, he states – based on IPCC figures – that in order to avoid a further increase of greenhouse gases in the atmosphere, a reduction of 3000 million tons of carbon is required per year. The price of reduction or the price of extra absorption will depend on several factors: whether owners of carbon sinks are poor or not, whether the commitment to reduce emission is low or not … "The stronger and quicker the commitment to reduce, the higher the marginal cost of the reduction" (ibid., 231). Martinez-Alier estimates the average

cost of carbon reduction at US$20 per ton, implying an ecological debt of US$60 billion per year when the necessary reductions are not made. "As a term of comparison, the present accumulated Latin American debt was in 1999 US$700 billion (equivalent to only 12 years of 'carbon debt' at US$60 billion per year) (…) The point is to consider that the external debt from south to north has already been paid on account of the ecological debt the north owes to the south, and to stop the ecological debt from increasing any further" (ibid., 231, 233).

As shown above, Martinez-Alier considers ecologically unequal exchange as one of the important mechanisms underlying ecological debt and thus as one of the crucial elements in stopping ecological debt from increasing any further. According to Martinez-Alier, ecologically unequal exchange has two causes (ibid., 219). First, the fact that the strength necessary to incorporate negative local externalities in export prices is often lacking in the south. Second, the ecological time necessary to produce the goods exported from the south is frequently longer than the time required to produce the imported manufactured goods or services. We will return to the implications of ecologically unequal exchange later on (1.3.2.).

To conclude, what do we learn from Martinez-Alier (2002) for the current research project?

1. Two underlying mechanisms explain ecological debt: ecological unequal exchange and disproportionate use of environmental space and services
2. Ecological debt is treated as an economic concept expressed in monetary terms, because this is the language best understood in the north
3. The external debt of the south has already been paid on account of the ecological debt
4. The ecological debt has to stop increasing, which implies that the two underlying mechanisms have to be changed

1.2.4.5. *Torras (2003): ecological deficit and ecological debt, using footprints*

Torras (2003) explicitly refers to previous work of Martinez-Alier[10] and explores the possibility of using ecological debt in the context of external debt relief. He states that a country imposes an environmental cost on other countries to the extent that it is able to consume at a level that commands more material resources than are available domestically. This justifies "ecologically-based, crosscountry compensatory transfers" (ibid., 2162) for two reasons. First, since colonial times LDCs have provided richer countries with much of the material means to consume at higher levels than otherwise possible. Second, some measure of external debt relief is required if significant economic development has to stand a chance and the spatial ecological maldistribution offers a justification and a basis for determining compensation.

In a first step, Torras uses the ecological footprint methodology to calculate the physical aspects of ecological debt. In fact, he uses the term *ecological deficit*, which in footprint analysis means the amount by which a country's ecological footprint exceeds the locally available ecological capacity. He reserves the term ecological debt for "the monetary equivalent of a country's ecological deficit" (ibid., 2164). For ecological deficit, his calculations are based on the *Living Planet* Report (Loh 2000). Among all countries in ecological deficit, he counts only the industrialised countries, since he thinks it makes little sense to engage LDCs in a compensation scheme. This leaves him with 16 debtors. On the

[10] But only in as far as the concept is concerned; his methodology is not related to Martinez-Alier's proposals (compare with 1.1.2.4)

side of ecological creditors, he counts only LDCs which really have an ecological surplus[11], which leaves him with 46 countries.

Then the question pops up what portion of ecological deficit should be allocated to the surplus countries. The same argument is made as we made in previous reports and as we encountered in Azar and Holmberg (1995): part of the ecological deficit is carrying capacity appropriated in creditor countries (spatial maldistribution), but another part of it is appropriated from future generations (temporal maldistribution). Torras works with two assumptions: a first calculation based on 5% appropriated carrying capacity in other countries (which means that no less than 95% of ecological deficit/debt is due to future generations) and a second calculation based on 10% appropriated carrying capacity elsewhere, so 90% is due to future generations, "unrealistically high, in all likelihood, but I prefer to err on the side of being too conservative" (ibid., 2164). He does not mention upon what these figures are based. The total ecological deficit of the 16 debtors is 3,7 billion area units, which means that under the 5-10% ACC assumptions the monetary equivalent of either 186,7 million or 373,4 million area units is available to be allocated among the 46 surplus countries (ibid., 2165).

The next step is to valuate these ecological deficits. Matters now become more complicated because no estimates of area unit value exist. Torras uses a famous article by Costanza et al. (1997), which tries to estimate the monetary value of the services of all the globe's ecosystems, but he modifies the numbers and finally comes up with an estimated value per area unit of $ 4400. "This make the total ecological debt to be allocated among recipient countries $ 812,5 billion in the case where ACC equals 5% and $ 1,64 trillion[12] when ACC is assumed to equal 10%" (ibid., 2166).

The last step is to find a method of transferring this money to creditor countries. Again, he proposes two methods. First, allocation based on total exports, assuming that a greater magnitude of exports implies larger transfer of biocapacity from LDCs to support consumption in rich countries[13]. Second, population size assuming that every individual in ecological surplus countries should benefit equally, implying that countries with large populations receive larger transfers. His results are shown in figure 4 and 5: external debts prior to transfers are compared with external debt or even credit after transfer. In general, there are significant potential gains for indebted LDCs, although depending on the criterion employed, Latin American countries gain more with the export criterion, African countries more with the population criterion. The criterion employed makes little difference to Asian countries.

[11] This leaves out countries such as Bangladesh, China and Egypt; see *Living Planet Report* for the full list of ecological deficit countries. Torras admits that other criteria are possible – e.g. transfers based on the 'fair earth share' – but this is beyond the scope of his article.

[12] 10^{12}

[13] Export figures are based on dollar value; it might have been more interesting to use a physical measure, e.g. ton

Figure 4. Adjusted debt when transfer based on total exports (million dollars) (Torras 2003)

Country	ACC = 5%		Country	ACC = 10%	
	Debt after transfer	Debt prior to transfer		Debt after transfer	Debt prior to transfer
Top 10 debtors					
Brazil	49,036	180,780	Mozambique	5,525	7,566
Argentina	43,973	111,930	Congo, DR	4,947	12,826
Peru	11,975	29,328	Nicaragua	2,078	5,932
Congo, DR	8,886	12,826	Zambia	1,760	7,054
Côte d'Ivoire	7,556	19,524	Tanzania	1,292	7,362
Mozambique	6,546	7,566	Guinea-Bissau	801	937
Cameroon	4,652	9,542	Mali	506	3,006
Zambia	4,407	7,054	Sierra Leone	399	1,179
Tanzania	4,327	7,362	Madagascar	234	4,146
Nicaragua	4,005	5,932	Laos	233	2,263
	Credit after transfer	Debt prior to transfer		Credit after transfer	Debt prior to transfer
Top 10 creditors					
Malaysia	178,389	39,673	Malaysia	396,452	39,673
Venezuela	26,160	35,360	Indonesia	151,372	128,940
Indonesia	11,216	128,940	Venezuela	87,679	35,360
Paraguay	8,693	2,162	Brazil	82,709	180,780
Latvia	5,764	475	Colombia	38,489	28,900
Botswana	5,728	614	Argentina	23,985	111,930
Colombia	4,795	28,900	Paraguay	19,547	2,162
P N Guinea	4,619	2,507	Ecuador	13,217	14,495
Gabon	3,983	4,310	Uruguay	13,129	5,901
Uruguay	3,614	5,901	Angola	12,850	11,225

Figure 5. Adjusted debt when transfer based on population (million dollar) (Torras 2003)

Country	Assuming ACC = 5%		Country	Assuming ACC = 10%	
	Debt after transfer	Debt prior to transfer		Debt after transfer	Debt prior to transfer
Top 10 debtors					
Argentina	79,594	111,930	Argentina	47,259	111,930
Brazil	32,497	180,780	Gabon	2,245	4,310
Malaysia	20,274	39,673	Panama	1,159	6,069
Venezuela	14,876	35,360	Malaysia	876	39,673
Peru	7,342	29,328	Congo, Rep.	405	5,241
Côte d'Ivoire	6,772	19,524	Uruguay	−51	5,901
Ecuador	3,755	14,495	Guinea-Bissau	−1,105	937
Panama	3,614	6,069	Bhutan	−1,201	114
Gabon	3,278	4,310	Botswana	−2,133	614
Uruguay	2,925	5,901	Nicaragua	−2,420	5,932
	Credit after transfer	Debt prior to transfer		Credit after transfer	Debt prior to transfer
Top 10 creditors					
Indonesia	52,073	128,940	Indonesia	233,087	128,940
Myanmar	34,651	5,184	Brazil	115,786	180,780
Congo, DR	28,722	12,826	Myanmar	74,487	5,184
Tanzania	20,629	7,362	Congo, DR	70,270	12,826
Uganda	14,450	3,674	Tanzania	48,621	7,362
Ghana	9,646	6,442	Colombia	43,235	28,900
Madagascar	8,449	4,146	Sudan	32,901	16,972
Cambodia	7,969	2,100	Uganda	32,574	3,674
Sudan	7,965	16,972	Ghana	25,734	6,442
Mozambique	7,335	7,566	Mozambique	22,235	7,566

Some comments. Torras remarks that results will differ with alternative assumptions, such as a calculation of ecological deficit on an ecological footprint per capita basis instead of on available biocapacity. He does not refer to possibilities of using this methodology backward in time. His calculations are based on 1 year. Although he mentions that the temporal aspect of ecological debt is enormous (90% to 95% of ecological deficits), he does not give indications of what should be done with this intergenerational debt and how it can be

compensated for. Finally, he takes external debts as given and does not mention the debate on the legitimacy of the external debt, e.g. the question of so-called odious debt[14].

To conclude, what do we learn from Torras (2003) for the current research project?

1. he starts from a physical quantification, based on footprint analysis.
2. he allocates a small part of ecological deficit/debt to creditor countries (5% to 10%), a large part to future generations; what this allocation is based upon, is not clarified.
3. the monetary valuation typically poses a lot of problems.
4. the monetary valuation functions within a clear context: external debt relief; the external debt context is treated as given
5. not all developing countries qualify automatically as eligible for money transfers; only countries with an ecological surplus qualify (although methods to define the ecological surplus can vary)
6. there is no indication of whether and how this methodology can be used backwards in time. The calculation is based upon 1 year.

1.2.5. Some conclusions and implications for the current project

Ecological debt is a relatively new concept. It dates back to the late 1980s, early 1990s and in this period it has been mainly used as a campaigning instrument rather than a research subject. First efforts to elaborate a framework underlying the concept of ecological debt have been done by a rather small amount of people. It is clear that this concept – but also the campaigning attached to it – is in a developing phase. This has several consequences.

Firstly, it is difficult to define exactly what is meant by ecological debt. Several definitions exist alongside each other, in the campaigns as well as in the available scientific articles. Consequently, a lot of terms and components are interpreted differently. Some examples may illustrate this point.

- Who exactly are the debtors and the creditors? Is it a case of countries in relation to other countries, or should actors within these countries be specified, as is implicated in some recent definitions? Does this have implications for compensation for or future avoidance of ecological debts?
- Can all damage caused by industrialised countries be characterized as ecological debt vis-à-vis developing countries? Should part of it not be characterised as debts in relation to future generations? What is the role of countries with economies in transition? Is ecological debt between developing countries conceivable?
- In what way should ecological debt be expressed? Is it an economic concept, as Alier states, and does this imply that ecological debt has to be monetised? Or is a physical form of expression possible? Or perhaps a combination of the two?
- Have all forms of ecological debt been initiated during the colonial period?

Secondly, a uniform methodology for quantification does not exist. Most attempts focus on monetary quantification, although a physical quantification is often underlying and a necessary first step. Calculations are always limited in time; they go back (e.g. for carbon

[14] In international law, sovereign debt is considered odious when (1) its purpose does not benefit the people and (2) it is incurred without the consent of the people (Kremer and Jayachandran 2002). Potential recent examples include Congo/Zaïre (Mobutu), South Africa (apartheid regime), Nicaragua (Somoza), Philippines (Marcos), Nigeria (Abacha), Croatia (Tudjman). Odious debt should not be transferable to a successor governments, especially if creditors are aware of these facts in advance (ibid.). The most recent example of potential odious debt is Iraq.

debt) to at most 15 years, and often just one year is calculated. The most important arguments we have encountered in the literature for monetisation are 'political' arguments, graphically summarized by Common as 'the cultural soup argument': monetary measures have a strong influence on policy makers and public opinion, it is the language best understood in the North etcetera. Of course, when ecological debt has to serve as a counterpart to the external debt, it is not just the 'cultural soup argument' which counts: monetary quantification can then serve as an argument for debt cancellation. To complicate the picture further, in the NGO campaigns different positions exist regarding the desirability of calculation in monetary terms

Thirdly, the discussion on what should be done politically with ecological debt, how it can be introduced at different political levels, how it should be interpreted in different contexts is very limited. Most stress is on a double form of recognition: recognition of the ecological debt and, as a counterpart, recognition of the illegitimacy of the external debt of Third World countries. Until now, there are no references as to where this recognition must happen, how it should be initiated and who should initiate. Most demands focus on restructuring international mechanisms and industrialised production and consumption patterns in order to avoid *new* ecological debts. Focus is on what should be done in the climate debate. Still, organisations which are part of the campaigns on ecological debt, have different views on the 'radicalism' of actions to be taken.

Several factors contribute to this situation: the development happens bottom-up through NGO campaigning, with different definitions and interpretations being used and new applications appearing; most of these NGOs have only limited means to campaign, do some research and lobby; direct scientific literature on the concept is almost non-existing; the link between campaigning and scientific work is weak.

All of this does *not* mean that the concept of ecological debt does not relate to a real problem. There is of course ample literature and documentation on historical and current (ecological) damage in developing countries or to global ecosystems, caused by industrialised countries. With its stress on historical responsibility, the concept of ecological debt adds a meaningful new dimension to the sustainability debate. The sustainability debate tends to be exclusively forward-looking or future-oriented. Ecological debt draws attention to how the present situation has grown out of the – often violent and unjust – past. This historical dimension cannot just be ignored in the quest for a more sustainable world order.

Furthermore, the linkage between external and ecological debt brings a new political perspective to international relations, i.e. a reversal of the creditor-debtor relation. The concept of ecological shows that countries can be in a creditor-debtor relationship on the basis of physical-ecological relations. Through the concept of ecological debt industrialised and developing countries stand in another relationship: the North as debtor, the South as creditor. Southern movements sometimes formulate this as 'empowerment' of the South and Southern peoples in international relations.

The NGO's participating in the campaigns consider this new way of looking at past and present relations between countries as one of the important 'eye-openers' of ecological debt. This new perspective is confirmed by the discussion of the few available scientific articles on ecological debt. Since ecological debt is an evolving concept, the new perspectives which ecological debt makes possible, have not crystallized out yet, but according to the NGOs participating in the campaigns, they include (partly based on discussions with members of the international reading committee and the JADES group, Paris 12 november 2003):

- A different political perspective: the North as debtor, the South as creditor. Ecological debt provides a different look not only at the legacy of the colonial period, but also at 'the era of development' after World War II: a lot of this development has been debt-driven, not only in financial terms (South-North) but certainly in ecological terms as well (North-South).
- A different economic perspective, in particular in the field of trade: ecological debt shows that trade has often not been mutually beneficial, neither in monetary terms, nor in ecological terms. This points to the need for different analyses and perspectives on trade, which are not to be found in neo-classical trade theories, nor in current trade policies.
- A different ethical perspective: ecological debt points at the collective responsibility of industrialised countries for past and ongoing violations of the right to a clean and safe environment in other countries, in particular in the South
- A different ecological perspective: ecological debt is another way of revealing the impossibility and undesirability of copying development paths of industrialised countries

Finally, the concept of ecological debt seems to draw together comparable experiences from (local) groups all over the South and to unite them under the new label 'ecological debt'. This makes it easier to articulate the common concerns visible in protest against e.g. shrimp farming, mining, oil and gas exploitation or the overuse of the absorption capacity of the atmosphere.
All these characteristics of the concept (bringing a historical perspective to the sustainability debate; bringing a new perspective on debtors-creditors to international politics; uniting comparable experiences of Southern peoples) can be seen as an example of what in theories on social movements is called 'cognitive praxis'. Eyerman and Jamison (1991) stated that one of the most important characteristics of social movements is their ability to 'produce' knowledge. All (scientific) knowledge is socially constructed, which implies that out of the knowledge interests of social movements, new perspectives on reality can grow. Through the use of the concept of ecological debt, social movements (from the South) are opening up a new context for interpretation – and in fact re-interpretation – of knowledge. The new perspectives, the new frame for looking at the world, open up a possibility – and when recognized a need – for rethinking of policies at different levels. These different characteristics of the concept turn ecological debt into a potentially powerful concept, but at the same time, due to the 'operational' weaknesses mentioned above, the usefulness of ecological debt in international policy and negotiations seems at the moment rather limited.

The critical evaluation of the concept made above, is thus more on the level of operationalisation than on the level of the concept as such. From the point of view of the current research project, the question is how to define, calculate and interpret ecological debt in such a way that it can be used in international policy and negotiations. If these kind of questions can be answered, the usefulness of the concept can be greatly enhanced.

It can of course be argued that a lot of concepts and ideas which guide international policy are not well defined and are even differently interpreted by different actors. Examples abound: 'democracy', 'justice', 'freedom', 'sustainable development', even 'the war on terror'. Still, we think ecological debt is not on the level of this category of concepts. Ecological debt is more on the level of concepts such as 'ecological footprint' or 'environmental space'. Ecological debt is one possible translation / operationalisation of (the convergence of) ideas such as sustainable development and justice, in the same way as ecological footprints and environmental space are translations / operationalisations of these two ideas. In order to be

usable in e.g. sustainable development policy, confusion over the contents of ecological debt has to be as minimal as possible.

This is one of the reasons by the way, why an initiative was taken by amongst others Mathis Wackernagel – one of the inventors of ecological footprinting – to launch a new organisation on ecological footprints, The Global Footprint Network (www.ecofoot.net). The popularity of the ecological footprint concept threatened to undermine its own success: because of the amount of organisations working with and promoting ecological footprints, different interpretations and methodologies were spreading fast. The new website aims at "advancing the scientific rigor and practical application of the Ecological Footprint (…) The continued usefulness of the Footprint depends not only on maintaining its scientific credibility, but also on the consistency with which the method is applied and results communicated across different contexts"

1.3. The problem of definition

In the course of the research project, considerable time has been devoted to the problem of defining ecological debt. One reason for the discussion on definition is inherent to the project. The modular research on energy/climate and agriculture/food supply aims at quantification of part of Belgian's ecological debt. This exercise is impossible without a clear definition and clear indications of what should be calculated and in what way figures should be interpreted. For the modular research on juridical implications of the concept and its link with multilateral environmental agreements, it is equally necessary to know exactly which concept we are talking about.

For the core research of the project, the discussion on definition is part of the goals of clarification of the concept and its applicability in international policy and negotiations. Until now, the concept has almost exclusively been used in the context of NGO awareness raising and in a limited number of scientific articles. As was mentioned above, the current state of the concept raises several difficulties when wanting to apply the concept in an international policy context. In order to deal with these problems, the research investigated the underlying problem of defining a new concept such as ecological debt and, even broader, what a definition actually is.

Martinez-Alier (2002, 228-229) makes an interesting point when he notes that different languages can be used to define and discuss ecological debt. Martinez-Alier clearly uses the language of economics, which "implies monetization of Nature's services. I confess, *mea culpa*. My excuse is that the language of chrematistics is well understood in the north."

He suggests other possible languages such as the language of environmental justice, environmental security or religion. Religious overtones are e.g. clearly present in Aurora Donoso's paper 'Ecological debt: the desecration of life'[15], where she states that the mechanisms which create ecological debt, also destroy life and creation. "What we seek to recover and defend is the value of the sacred. To recover our relationship with creation, with the all" (2001, 3). The concept of ecological debt became part of the Jubilee 2000 campaign of Christian churches for cancellation of external debt.

[15] The paper was presented at the' Sacred Earth, Sacred Community' Theological Forum of the Jubilee 2000 campaign in Toronto

A language which is certainly relevant here is the language of injustice, indignation and resistance. The language of the campaigns, in particular the language used by Southern NGOs, testifies of indignation at the present position and treatment of Third World countries in international relations and indignation at the destruction of nature. NGOs such as Acción Ecológica clearly hope that the concept of ecological debt and the claiming of that debt can be a rallying point for the resistance of Third World countries and peoples against that world order and its consequences.

What we will be looking for in this paragraph is a language which makes it possible to communicate about ecological debt during e.g. international negotiations, but without losing the intrinsic qualities and 'core meaning' of the concept.

1.3.1. Some background and theory on definitions

The problem of definition has given rise to an extensive literature in Logic and language philosophy. In (Western) philosophy this issue dates back to Plato and Aristotle. Contemporary philosophy distinguishes between several types of definition, which can be classified in different ways. In general, a definition always serves a purpose and is situated within a context. The accuracy of the definition has to be adapted to the purpose and the context. A definition does not have to be more accurate than its use requires (de Boer 1999, 20). Moreover, a term or concept can be defined in several ways which need not exclude each other but which can be complementary. In their classic textbook Copi and Cohen (2001) distinguish between five kinds of definition: stipulative, lexical, precising, theoretical and persuasive definitions. The first three are most relevant to the problem of defining ecological debt.

Copi and Cohen distinguish five kinds of definition:

- stipulative definitions are definitions in which a new (or existing) term is introduced to which a meaning is arbitrarily assigned. A stipulative definition is an explicit and selfconscious setting up of a meaning-relation between some word and some object or concept (Shaw s.d., 4). Or simpler, one chooses one's own meaning or interpretation for a word. As a consequence, stipulative definitions cannot be true or false, accurate or inaccurate. They can only be meaningful or useful.
- lexical definitions report the meaning(s) that a term already has. They are the kind of definitions found in a dictionary and are a description of the way speakers of a particular language use a particular term
- precising definitions are definitions devised to eliminate vagueness by delineating a concept more sharply. They are important in law and legislation but they also serve to define in what exact way an object has to be measured.
- theoretical definitions are part of a comprehensive theoretical framework for understanding a certain subject matter. They attempt to formulate a theoretically or scientifically useful description of the object to which the term applies.
- persuasive definitions are formulated and used to resolve a dispute by influencing attitudes or stirring emotions, often relying on the use of emotive language. The description is done with terms which have strong positive or negative connotations.

This classification can be further refined by distinguishing different methods or techniques for defining. In general, two techniques exist: definition through extension or definition through

intension. The extension of a term is the collection of all objects to which it may be correctly applied. The extension of the term 'multinational' is the collection of all multinationals. The intension of a term is the set of attributes shared by *all* objects to which the term refers, and shared *only* by those objects. The intension of the case 'multinational' is the set of characteristics shared by all multinationals. These characteristics distinguish multinationals from other firms.

The distinction of definitions by kind and by technique can be summarised in the following scheme. The different combinations of 'kind' and 'technique' often have a specific name.

	Techniques	
Kind of definition	**Extensional definitions**	**Intensional definitions**
stipulative	• definition through examples	• Definition 'per genus et differentiam', or first identifying the larger class ('genus') the term belongs to, and then identifying the attributes ('differentia') that distinguish it from all others members in that genus
lexical	• Definition through examples	• Synonymous definition, or defining through providing words (synonyms) or that have the same meaning as the first • Definition 'per genus et differentiam'
precising	• Ostensive definition, or defining an object by pointing or another gesture • Quasi-ostensive definition, or defining by a gesture and adding a descriptive phrase	• Operational definition, or defining in such a way that the object can be measured
theoretical	• Quasi-ostensive definition	• Definition 'per genus et differentiam'
persuasive		

Source: based on Copi and Cohen (2001)

Finally, the literature on definitions often formulates rules on how to draw up definitions. These are rules to be aimed at, rather than strict requirements. The most important rules are:

- Completeness: a definition should state the essential attributes of a term or concept
- Neither too broad nor too narrow: a definition must be broad enough to cover many of the existing uses of the term and narrow enough to distinguish one term from another (ecological debt from non-ecological debt)
- No circularity: a definition should not use the term to be defined
- Goal-oriented: a definition must be effective, suited to the goal it is made for
- Context-sensitive: a definition has to fit a particular context, which means that (a) the primitive terms[16] must be well-understood and (b) ambiguous, emotive or figurative language must be avoided
- A definition should not use negative terms when it can be affirmative

[16] Primitive terms are terms which are not defined because their meaning is supposed to be clear; all definitions use primitive terms.

1.3.2. Ways of defining ecological debt

Let us now see whether this classification is helpful in clarifying the discussion on the definition of ecological debt.

A lexical definition of 'ecological debt' does not exist since the term does not appear in dictionaries. Of course, 'ecological' and 'debt' are in the dictionary, but using lexical definitions is not very helpful for our purposes, neither in trying to give a concept a scientific base, nor in looking for international recognition of it. Lexical definitions describe the way a term is used in a particular language. Usage may (and will) differ between languages. This is demonstrated by the meaning of 'debt' and its Dutch equivalent 'schuld'. In English, 'debt' means '1. a sum of money that somebody owes', '2. the situation of owing money' or '3. the fact that you should feel grateful to somebody because they have helped you or been kind to you'. In Dutch, 'schuld' has the same meaning, but it also has a meaning which is translated by the English 'guilt', or 'the fact that somebody has done something wrong or illegal' and 'the blame or responsibility for doing something wrong or something bad'. In other words, 'ecological debt' and its Dutch equivalent 'ecologische schuld' have different connotations which will interfere in discussions when a lexical definition of ecological debt is used.

This points to the need for another way of defining ecological debt. Since ecological debt is a new term, a stipulative definition will be necessary. Without calling it that way, this is of course what has happened in practice. The definitions cited above[17] are stipulative definitions. The concept ecological debt which had no meaning before, has been given a meaning. As has been shown above, the meaning of ecological debt is not fixed yet: different participants in the debate use different definitions and definitions seem to change over time. Strictly speaking, this is no problem in terms of stipulative definitions ("choosing one's own meaning or interpretation for a word"), but it may become in problem in trying to get the concept accepted. Shaw (s.d., 5) remarks that stipulative definitions are in fact artificial definitions, and for "a good level of acceptance of the definitions" they need "maintenance" (o.c., 17). Lexical definitions simply 'exist' and maintain themselves. "Stipulative definitions will not continue to be used without some maintenance and the maintenance work is much easier if the audience for the definitions has a good understanding of their development, importance and credibility".

The point of stipulation is to avoid ambiguity and vagueness of terms used – within a context and for a purpose. This implies that, within a specific context and for specific purposes, existing definitions of ecological debt may be adequate, while in other contexts and for other purposes, definitions are not adequate or elements out of existing definitions may need further stipulation. In a campaign aimed at building NGO networks or awareness raising, terms such as 'resource plundering' or 'unfair trade' (cf. 1.2.1.) may not need further explanation. When one wants to introduce the concept e.g. at UN level in international negotiations, further refinement or other terms will probably be necessary.

What with precising definitions, and more in particular operational definitions of ecological debt? The goal of an operational definition is to describe completely, with full and explicit information, how a concept will be measured. De Boer (1999, 14) adds that usually a specific

[17] Such as "ecological debt is the debt accumulated by Northern, industrialised countries towards Third World countries on account of resource plundering, unfair trade, environmental damage and the free occupation of environmental space to deposit waste" (Martinez-Alier, Simms and Rijnhout 2002, 1)

feature of a concept will be measured. A concept often theoretically means more than can be measured in a single way, implying that it can be operationally defined in more than one way. Different operationalisations may correlate or overlap; some may be more important or useful than others. This will be important when searching for operational definitions later on in the current research project (see also 1.4.). As has been shown above, a consistent methodology for operationalising ecological debt does not exist. Some rough monetary calculations have been done for carbon debt, but methodologies differ and are sometimes disputable. A methodology for physical calculations does not exist.

A final remark on persuasive definitions. In the literature, these are evaluated negatively for use in scientific research because of their lack of neutrality. Of course, what is considered 'neutral', 'emotive language' or 'positive and negative connotations' depends on the context. For some Northern ears, terms used in definitions of ecological debt such as 'plundering of resources' or 'looting of natural goods' have negative connotations, while for Southern ears they may be an adequate description of the situation. Still, the influence of these connotations may be kept in mind when defining ecological debt for particular purposes and in particular contexts.

Let us try to draw some interim conclusions from 1.3.1. and 1.3.2. We think the following points should be kept in mind:

- Definitions function within a context and serve a purpose. Most of the existing definitions of ecological debt have been developed through NGO campaigns which aimed in particular at awareness building and networking. The context of this research project is international policy and the purpose is applicability in that context. Implications will be further discussed in 1.3.3.
- The different kinds of definitions are complementary. Research into a methodology for calculation of ecological debt (operational definition) does not necessarily imply narrowing the concept (stipulative definition). The operational definition may be an operationalisation of one specific feature of the broader concept. It should of course be clear which feature it is and how the operationalisation is done.
- Although definitions can be classified by kind and by technique, a strict line between the different classes cannot be drawn. This is best visible with the qualification of a definition as stipulative or persuasive, but it also holds for the line between stipulative and operational definitions. Depending on purpose and context, stipulation will have to be more or less detailed before operationalisation is possible.

1.3.3. Towards a stipulative definition of ecological debt

1.3.3.1. Robustness of existing definitions

The discussion so far might seem to imply that each context and each purpose necessitates its own (stipulative) definition of ecological debt. While this is theoretically possible, it would of course be counterproductive for understanding what is meant by ecological debt. "Stipulate as little as possible" is one of Shaw's guidelines, and "once a word is stipulated we must ensure that in our work it is never used in another sense" (s.d., 5). Therefore, a better way of tackling the problem is to look for a very general definition which is suited for all purposes and contexts. For particular purposes and contexts this definition may need further refinement, but without changing the initial, general definition. In a third step, operational definitions for

specific features of ecological debt can be searched for. In general, the procedure can be the following:

1. formulate a general stipulative definition of ecological debt, suited for all purposes and contexts
2. when necessary, refine the definition for particular purposes and contexts
3. formulate operational definitions for specific features of ecological debt

The question then becomes: is there an existing definition of ecological debt which at this moment can serve as our 'general stipulative definition', suited for all purpose and contexts? We showed above that several definitions of ecological debt exist, which are not always consistent with each other. Furthermore, several aspects of the concept are unclear. In spite of these shortcomings, it has to be admitted that the concept has been successful in rallying support from grassroots organisations and Southern and Northern NGOs. It has also made its first appearances in speeches from some government representatives during international negotiations (cf. the part of this report on MEA's). So for the purpose of awareness raising, NGO networking and some mention on international level, existing definitions have been enough. This may well be because ecological debt captures in two words processes which many had noticed, but could not formulate. Still, we doubt whether existing definitions are robust enough to stand the test when applicability in international policy negotiations is required.

To illustrate the point, let us again take the definition already mentioned in footnote 2: "Ecological debt is the debt accumulated by Northern, industrialised countries towards Third World countries on account of resource plundering, unfair trade, environmental damage and the free occupation of environmental space to deposit waste" (Martinez-Alier, Simms and Rijnhout 2002, 1). We limit our comments to one example, 'unfair trade'. Is 'unfair trade' the opposite of 'fair trade'? Fair trade as defined by IFAT, the International Fair Trade Association is "a trading partnership, based on dialogue, transparency and respect, that seeks greater equity in international trade. It contributes to sustainable development by offering better trading conditions to, and securing the rights of, marginalized producers and workers – especially in the South." Are all trade practices which do not fit this definition a cause of ecological debt? We think that a definition which can be tackled with just two questions is not robust enough for use in particular contexts and purposes, i.e. international negotiations and applicability in international policies.

1.3.3.2. *Elements for a stipulative definition: formulating a working definition*

So, how to formulate a definition which is broad enough to cover the content we want to be covered and one which can be used in all relevant contexts and for all relevant purposes? One way of proceeding is to

1. make explicit the content ('the core meaning') we want to be covered and look for the most general formulation of them
2. make explicit relevant contexts and purposes

We will try to formulate elements for such a definition and give an idea of the direction such a definition might take. This will serve as a working definition during the project.

In order to be able to formulate a working definition, it is necessary to make explicit the 'core meaning' of ecological debt. This core can be covered in the description of two processes.

The first one is that relations between countries can be described in several ways, and that the physical-ecological relation has often been neglected. In accumulating wealth, countries and actors within these countries do not only use their own natural resources, but also make use of natural resources elsewhere. Since colonial times, this relationship has been constantly in favour of the present industrialised nations. The wealth of industrialised nations has been built extensively on natural resources from elsewhere, in particular from present developing countries (but not exclusively). This specific feature of wealth accumulation has caused severe disruptions of ecosystems in developing countries. Disruptions of ecosystems have often been accompanied by social, economic and cultural upheavals[18]. This physical-ecological relation between countries is not only something from the past, since present-day relation are still characterised by it. Nowadays, transnational corporations are important actors in the shaping of these relations.

A second process is that in accumulating wealth countries and actors within these countries do not only cause ecological damage elsewhere, but also increasingly put pressure on ecosystems and ecosystems services, even if no immediate damage is visible. Until now, in particular industrialised countries have been responsible for this pressure. The use of these ecosystems and ecosystem services limits their use by other countries and by future generations and as such has far reaching social and economic consequences. A typical example is the use of the sink capacities of the atmosphere which are used in such quantities by industrialised countries, that emission possibilities of other countries are severely limited (presupposing of course that the policy option is prevention of climate change).

We think – but this is open for discussion – that these formulations come close to the essential processes made visible by 'ecological debt', although they may not yet cover all items necessary. Since the focus of the research project is on the role of countries in the ecological debt debate, we first tried to formulate a working definition suitable for the project, i.e. a working definition of what was called above 'public ecological debt'. What direction might such a working definition take? Perhaps something like:

> "The ecological debt of country A consists of
> (1) the ecological damage caused over time by country A in other countries or in an area under jurisdiction of another country during its process of wealth accumulation,
> and/or (2) the ecological damage caused over time by country A to ecosystems beyond national jurisdiction during its process of wealth accumulation,
> and/or (3) the exploitation or use of ecosystems and ecosystem services over time by country A at the expense of the equitable rights to these ecosystems and ecosystem services by other countries or individuals."

Or more in line with terminology typical of sustainable development:

[18] cf. Wolfgang Sachs in a recent paper : "For resource flows do not come only with an ecological rucksack, in the form of an indirect use of materials. In some circumstances, they also come with social rucksacks in the form of human rights violations" (Sachs 2003, 7)

"The ecological debt of country A consists of
(1) the ecological damage caused over time by country A in other countries or in an area under jurisdiction of another country through its production and consumption patterns,
and/or (2) the ecological damage caused over time by country A to ecosystems beyond national jurisdiction through its consumption and production patterns,
and/or (3) the exploitation or use of ecosystems and ecosystem goods and services over time by country A at the expense of the equitable rights to these ecosystems and ecosystem goods and services by other countries or individuals."

In 1.3.4. several aspects of this definition will be further refined (e.g. different categories of 'damage', 'ecosystem services', 'equitable rights'). Here we take a general look at some characteristic features of the definition:

- as mentioned, this definition focuses only on ecological debt of countries, or what might be called 'public' ecological debt (see 1.1. and footnote 6). This is a consequence of the choices made in the project: study of applicability in international policy, relation with multilateral environmental agreements, calculation in the modules of aspects of Belgium's ecological debt. The project does not occupy itself with the ecological debt of other entities, such as companies, which might be called 'private' ecological debt. As a consequence, definitions, methodologies, calculations, policy implications etc. only refer to countries. Still, the working definition might perhaps be usable in the case of companies as well by simply replacing 'country A' by 'company A' or even 'entity A' (see the discussion a few paragraphs further on).
- "Country" is not further defined so that in principle all countries can be ecological debtor or creditor (although in practice of course, industrialised countries will usually be debtors, developing countries will be creditors). An area under jurisdiction of another country means an area in which a country can legally exercise sovereignty or sovereign rights, such as the territorial sea and the exclusive economic zone
- "beyond national jurisdiction" refers to those area's in which no state can exercise sovereignty or sovereign rights, such as the high seas and space
- There has been some debate during the project on using "consists of" or "is the sum of". "The sum" was not chosen because it suggests that all forms of ecological debt can be translated to the same denominator and simply added up. This is only true when the whole of ecological debt can be translated into e.g. footprints or money terms.
- Ecological damage is caused "over time": this explicitly adds the historical dimension
- There has been some debate during the project on the usage of "ecological damage" or "environmental damage". The terminology "ecological damage" is preferred because in juridical interpretations of the majority of environmental liability conventions and subsequent case law, the content of "environmental damage" is restricted to compensation and restoration, if possible, of traded natural goods (e.g. fish for consumption). This would imply that compensation for damage to non-economic, non-traded goods and based on economical techniques to assess the value of goods or services which have no market value, is not feasible within the concept of "environmental damage".

Does this working definition follow the rules for drawing up definitions mentioned in 1.3.1. (which are rules to be aimed at, rather than strict requirements)?

- Completeness: by first formulating the processes we want to be covered, we think the definition covers the essential attributes of (public) ecological debt.

- Neither too broad nor too narrow: we think the definition makes it possible to distinguish in general terms what is (public) ecological debt and what is not (although further refinements can make the distinction clearer).
- No circularity: the term to be defined is not used in the definition.
- Goal-oriented: this is difficult to assess; we think the language and terms used will sound familiar in an international policy context.
- Context-sensitive: the definition does not use emotive language; the primitive terms are not always easy to understand, but some are well-defined (e.g. under / beyond national jurisdiction) or commonly used (e.g. production and consumption patterns); for others further definition or refinement is possible.
- The definition does not use negative terms.

Can this working definition be broadened so that it becomes suited for all forms of ecological debt ('public' and 'private')? A suggestion is to replace 'country A' by 'entity A' or 'actor A', and make a slight amendment in the third part of the definition. The definition then reads:

> **"The ecological debt of entity/actor A consists of**
> **(1) the ecological damage caused over time by entity/actor A in other countries or in an area under jurisdiction of another country through its production and consumption patterns,**
> **and/or (2) the ecological damage caused over time by entity/actor A to ecosystems beyond national jurisdiction through its consumption and production patterns,**
> **and/or (3) the exploitation or use of ecosystems and ecosystem goods and services over time by entity/actor A at the expense of the equitable rights to these ecosystems and ecosystem goods and services by other countries or individuals."**

A problem with this definition can be that 'entity' has to be further defined: to which entities does it refer? Countries and companies, probably, but also individuals or still other entities[19]? Since the current research focuses solely on public ecological debt, we have not gone further into these kind of questions.

Finally, as stated above, a stipulative definition of ecological debt should be one which is broad enough to cover the contents we want to be covered and one which can be used in all relevant contexts and for all relevant purposes. Making contexts and purposes explicit is also relevant for knowing which items need more refining in specific contexts, and when operational definitions are necessary.

The following table is still very tentative. It is primarily intended to illustrate the point. Contexts and purposes have been based on goals or possible future goals of present campaigns.

[19] Such as in ecological footprint analysis, where footprints are calculated for countries, companies, individuals, consumer goods.

Purposes/Contexts	Stipulative definition (working definition)	Refinement of stipulative definition	Operational definition
Public awareness raising	"The ecological debt of country A consists of (1) the ecological damage caused over time by country A in other countries through its production and consumption patterns, and/or (2) the ecological damage caused over time by country A to ecosystems beyond national jurisdiction through its consumption and production patterns, and/or (3) the exploitation or use of ecosystems and ecosystem goods and services over time by country A at the expense of the equitable rights to these ecosystems and ecosystem goods and services by other countries or individuals."	Useful	Physical and monetary Which features?
Ngo networking		useful	
Recognition at UN level		necessary	Physical and monetary Which features?
Use in international policy: debt negotiations		necessary	Monetary Which features?
Use in international policy: United Nations Framework Convention on Climate Change (UNFCCC)		necessary	Physical and monetary Possible feature: carbon debt
Use in international policy: Convention on Biodiversity (CBD)		necessary	Physical and monetary Possible feature: impact of GMO's
Use in international policy: World Trade Organisation (WTO)		necessary	Physical and monetary; Possible feature: impact of international trade
Court cases (against multinationals, governments...)		useful	Physical and monetary; features depending on case
Scientific research		necessary	Depending on research
.....			

1.3.4. Refinements of the stipulative definition / working definition

The formulation of the working definition aims at usefulness in an international context, without losing the core meaning of ecological debt. It is possible to formulate further refinements for different terms. In this section we will formulate suggestions for refinements. Some of them will be tested in the modular research during the research project.

1.3.4.1. Does each alteration of the environment create ecological debt, or what is ecological damage?

Human activities alter the environment. Trade between countries almost always has a physical-ecological component, so that it will result in an alteration of the environment in both countries. The question then is, when does this become a problem? Or more in general, is there a definition of 'an environmental problem' or of 'ecological damage'?

These are long-standing and fundamental questions of environmental science, but a straightforward answer is not available[20]. Environmental science teaches us that alterations of the environment do not necessarily result in environmental problems. An environmental problem is a discrepancy between the desired state of the environment and the current or

[20] Paragraph based on Cörvers and Slot 1998, van der Heyden 1998

future state, but this discrepancy cannot be defined 'objectively'. Environmental problems are socially constructed, meaning that they are the result of a process in which actors through interaction with each other decide what these problems are, how they should be judged and how they might be solved. This combination of a) a social definition of a problem, b) its assessment and c) the solutions which are promoted, is called a discourse. In society, several discourses function alongside each other. They have a huge influence on the way individuals and organisations observe the world and on problems and solutions they perceive. Different actors will try to propagate their version of reality (their discourse). This means that depending on time, location, position and group different environmental problems will be formulated. It implies e.g. that the North will put other problems on the agenda than the South. That the concept of ecological debt originates from Southern NGOs and critical scientists is no coincidence. For most inhabitants of industrialised countries it is a most unusual and uneasy way of looking at their own position.

The last decennia have seen a rapid multiplication of 'socially discovering' environmental problems, leading to new conceptual frameworks and tools for describing them. One way of classifying environmental problems is by listing them by type of interference with the environment. We think this classification may be useful in deepening the understanding of ecological debt. Three kinds of interference can be distinguished:

- Pollution (Dutch 'verontreiniging') is the introduction in the environment of substances in amounts higher than natural background levels, causing damage to humans, animals, plants ecosystems and cultural heritage. Since it is possible to measure whether the concentration of a specific substance is higher than its background concentration, pollution can be defined objectively. The setting of a norm at which level the higher concentration is considered bad for environment or humans, is of course socially constructed.
- Depletion (Dutch 'uitputting') is the extraction or use of natural resources at such a speed or rate that the exploitation can but continue for a limited time at a certain level of quality. A distinction can be made between renewable and non-renewable resources. In the case of renewable resources, depletion is exploitation at such a rate or speed that natural regeneration capacity is strongly diminished or disappears. In the case of non-renewable resources, the situation is more complex. Strictly speaking, depletion means that the resource is no longer existent, but in reality depletion is determined by whether the resource is available in terms of e.g. existing techniques, costs of exploitation, (political) accessibility of the region etcetera.
- Degradation (Dutch 'aantasting') is the kind of interference which is the most difficult to define. Degradation is a structural change in landscape and / or ecosystems, causing a reduction of quality in diversity or productivity of that landscape or ecosystem. Degradation can be caused by a form of exploitation which does not deplete a resource or ecosystem, but which through constant exploitation profoundly changes that ecosystem. Discussions about whether reduction in quality is actually happening, are much more frequent than in the case of pollution or depletion.

1.3.4.2. *Should we distinguish between several spatial scales of ecological damage?*

A classification of environmental problems based on spatial dimensions, yields different problems for different spatial scales. In Dutch environmental policy, a classification of environmental problems according to spatial scale has been developed which may be helpful in the refinement exercise. Five spatial levels are distinguished:

- Global problems have an impact on the whole of the planet: climate change, ozone layer depletion
- Continental problems have an impact on the level of continents and oceans: acidification, winter smog, emissions into the air of heavy metals
- Fluvial problems have an impact on the level of seas and river basins: pollution of rivers, regional waters, salt waters
- Regional problems have an impact on the level of regions / landscapes and lakes: pesticides and herbicides in soil and ground water, pollution of soil and ground water by heavy metals, desertification, removal of waste, deforestation
- Local problems have on impact on the level of human habitats: noise nuisance, smell nuisance, air pollution in cities and in houses

1.3.4.3. To which ecosystems and ecosystem goods and services do countries have equitable rights?

Above it was stated that one element of the core meaning of ecological debt is the fact that in particular industrialised countries put so much pressure on ecosystems and ecosystem services that the rights of other countries and individuals to these services become severely constrained. This statement only makes sense when it is implied that access to ecosystems and ecosystem services is not a question of "first come, first serve", but that countries and individuals can claim some form of equitably distributed rights to these ecosystems and services. This raises a double question: which ecosystems and ecosystem services are we talking about and what is meant by equitable rights to them? The answers to these questions are intimately linked.

First, the meaning of "equitable". It is important to stress that this differs from "equal". If the term "equal" had been used, this would imply that every individual has an equal right to all ecosystems and ecosystem services. This is highly controversial, since it clashes e.g. with the sovereign rights of states on the use of their territory (see for this issue also the modular research on multilateral environmental agreements – part 4 of this report). Usage of the term "equitable" allows for different interpretations, with one of the interpretations being "equal". An interesting and usable classification of different meanings and operationalisations of equity is provided in an IPCC report on mitigation (see figure – IPCC 2001a). The application here is of course climate change and emissions, but the interpretations and operational rules can be inspirational for and translated to other ecosystems and ecosystem services.

Equity principles and burden-sharing rules

Equity principle	Interpretation	General operational rule
Egalitarian	Every individual has an equal right to pollute or to be protected from pollution	Allow or reduce emissions in proportion to population
Sovereignty	All nations have an equal right to pollute or to be protected from pollution; current state of emissions constitutes a status quo ("grand-fathering")	Proportional reduction of emissions to given or existing emission

		levels' or equal percentage of emission reductions
Polluter pays	Welfare losses corresponding to gains by emissions	Share abatement costs across countries in proportion to (eventually including historical emissions) emission levels
Ability to pay	Mitigation costs vary directly with national economic well-being	Equalize abatement costs across nations (costs as proportion of GDP equal for each nation)
Horizontal	All countries with similar features have similar emissions rights and burden-sharing responsibilities	Equalize net welfare change across nations– net cost of abatement as a proportion of GDP
Vertical	Welfare losses vary positively with national economic well-being, welfare gains vary inversely with GDP	Progressively share net welfare change across nations, net gains inversely and net losses positively correlated with per capita GDP
Utilitarian	Achieving the greatest good (happiness) for the greatest number	Maximize net present value of the sum of individuals utility (maximize social welfare).
Compensation	No nation should be made worse off	Compensate net losing nations
Rawls' maximin	The welfare of the worst-off nations should be maximized	Maximize the net benefit to the poorest nations
Market justice	Market justice	Allocate emissions permits to the highest bidder
Consensus equity	The negotiation process is fair	Seek a political solution to emissions reduction
Convergence	Equalize per capita emissions	Converge to an upper boundary of emissions
Environmental	The environment receives preferential treatment	Maximize environmental values and cut back emissions accordingly

Source: IPCC (2001a), p. 669

The egalitarian interpretation of equity corresponds to "equal" and is in the ecological debt debate almost always used for the discussions on climate change (see 1.1., 1.2. and the modular research on climate change). This egalitarian approach might also be used for other ecosystems and services. The Friends of the Earth campaign on environmental space explicitly stated that "energy and non-renewable raw materials are seen as global commodities, with globally accessible resources, global sinks and causing environmental problems on a global scale" (Spangenberg 1995b, p. 6) Consequently, these are divided on a per capita basis on global scale. Wood and agricultural products are regarded as continental resources, "so that each continent should have a balanced production and consumption, not occupying fertile land in foreign countries on a permanent basis" (ibid.). The per capita calculation is done on a continental basis. Finally, water is considered a regional resource "so the availability and the permitted use will be calculated on a regional basis" (ibid.).

Deciding which interpretation of equity should be used for which ecosystem goods and services will undoubtedly prove to be a difficult exercise. As Climate Action Network argues in a discussion paper, even for climate change it is difficult to adhere to a strict equal per capita position (CAN 2003). A kind of 'adjusted egalitarianism' may be considered here, where the per capita approach serves as a moral guiding principle but is modified by other considerations, e.g. historical responsibility, capacity to act or different geographical circumstances (see also part 3 on the modular research energy/climate, part 5 on policy implications and e.g. CAN 2003, Ott and Sachs 2000, Ashton and Wang 2003).

Apart from the 'equal' interpretation of 'equitable', others are possible. For example, in the case of information and knowledge on genetic resources, it is sometimes argued that traditional farmers or indigenous peoples are the owners of the knowledge, implying that there is no equal access for all inhabitants of the planet. In the case of raw materials, different interpretations exist. According to international law, countries have the sovereign right to the resources on their territory, but in debates on sustainable development one sometimes argues for a per capita approach (see FoE argument above). Still another form of 'equitable' might be an interpretation of equity as subsistence rights, which encompass what individuals need to develop as living beings: clean air and drinkable water, elementary health provision, adequate nourishment and clothing, and a roof over one's head (Sachs 2003, 30). Access to these services is a minimum to be able to speak of 'equitable' development.

It will of course be necessary to make explicit which ecosystems and ecosystem goods and services are relevant, and which interpretations of 'equitable' are assigned to them. In environmental science an ecosystem is defined as a community of different species interacting with one another and with their nonliving environment of matter and energy. The size of an ecosystem is arbitrary and is defined by the ecosystem one wishes to study. All of earth's ecosystems together make up the biosphere or the ecosphere (Miller 1995, 62). "Biomass production, biogeochemical cycling, soil and water relationships, and animal-plant interactions (including biodiversity) are considered to be some of the major functions of ecosystems. Within these functions, various products (goods) and services can be identified, including food, fiber, fuel and energy, fodder, medicines, clean water, clean air, flood/ storm control, pollination, seed dispersal, pest and disease control, soil regeneration, biodiversity, and recreation/amenity (…). Society places values on these goods and services, directly or indirectly. Ecosystems provide many of these goods and services simultaneously. For example, agricultural systems provide much of our food, fiber, and fuel needs and at the same time influence biogeochemical cycling, soil and water quality, and biodiversity. Many

services from ecosystems lie outside market systems, making it difficult to price them (…). However, these nonmarket values are likely to be larger (as much as 1,000-fold; …) than the value of services provided by markets in total and at many specific sites (…)" (IPCC 2001a).

In their exercise in valuing the world's ecosystem services, Costanza e.a. (1997)[21] grouped ecosystem goods and services into 17 major categories. For simplicity, they refer to ecosystem goods and services together as ecosystem services. To be as explicit as possible, we have kept the distinction between goods and services in the working definition, but the classification of Costanza e.a. gives an interesting overview of which ecosystem goods and services should be considered when discussing equitable access.

Table 1 Ecosystem services and functions used in this study

Number	Ecosystem service*	Ecosystem functions	Examples
1	Gas regulation	Regulation of atmospheric chemical composition.	CO_2/O_2 balance, O_3 for UVB protection, and SO_x levels.
2	Climate regulation	Regulation of global temperature, precipitation, and other biologically mediated climatic processes at global or local levels.	Greenhouse gas regulation, DMS production affecting cloud formation.
3	Disturbance regulation	Capacitance, damping and integrity of ecosystem response to environmental fluctuations.	Storm protection, flood control, drought recovery and other aspects of habitat response to environmental variability mainly controlled by vegetation structure.
4	Water regulation	Regulation of hydrological flows.	Provisioning of water for agricultural (such as irrigation) or industrial (such as milling) processes or transportation.
5	Water supply	Storage and retention of water.	Provisioning of water by watersheds, reservoirs and aquifers.
6	Erosion control and sediment retention	Retention of soil within an ecosystem.	Prevention of loss of soil by wind, runoff, or other removal processes, storage of silt in lakes and wetlands.
7	Soil formation	Soil formation processes.	Weathering of rock and the accumulation of organic material.
8	Nutrient cycling	Storage, internal cycling, processing and acquisition of nutrients.	Nitrogen fixation, N, P and other elemental or nutrient cycles.
9	Waste treatment	Recovery of mobile nutrients and removal or breakdown of excess or xenic nutrients and compounds.	Waste treatment, pollution control, detoxification.
10	Pollination	Movement of floral gametes.	Provisioning of pollinators for the reproduction of plant populations.
11	Biological control	Trophic-dynamic regulations of populations.	Keystone predator control of prey species, reduction of herbivory by top predators.
12	Refugia	Habitat for resident and transient populations.	Nurseries, habitat for migratory species, regional habitats for locally harvested species, or overwintering grounds.
13	Food production	That portion of gross primary production extractable as food.	Production of fish, game, crops, nuts, fruits by hunting, gathering, subsistence farming or fishing.
14	Raw materials	That portion of gross primary production extractable as raw materials.	The production of lumber, fuel or fodder.
15	Genetic resources	Sources of unique biological materials and products.	Medicine, products for materials science, genes for resistance to plant pathogens and crop pests, ornamental species (pets and horticultural varieties of plants).
16	Recreation	Providing opportunities for recreational activities.	Eco-tourism, sport fishing, and other outdoor recreational activities.
17	Cultural	Providing opportunities for non-commercial uses.	Aesthetic, artistic, educational, spiritual, and/or scientific values of ecosystems.

Source: Costanza e.a. (1997), p. 254

Figure 7 gives an idea of how different ecosystem goods and services may be combined with different interpretations of 'equitable'.

[21] This study is also used in Torras (2003), see 1.2.4.5.

Ecosystem goods and services	Equity principle	Interpretation
Climate regulation	Adjusted egalitarianism	per capita approach serves as a moral guiding principle but is modified by other considerations, e.g. historical responsibility, capacity to act or different geographical circumstances
	Other approaches for climate: see figure of IPCC (2001a) above	
Raw materials	Sovereignty	Nations own the resources on their territory
	Egalitarian	Every inhabitant on earth has an equal right to resources anywhere
Genetic resources	Sovereignty	Nations own the resources on their territory
	Group rights	Groups such as traditional farmers and indigenous peoples who have the knowledge of the genetic resources, own the knowledge
Food / Water supply	Subsistence rights	Everybody has a right to clean air and drinkable water, elementary health provision, adequate nourishment and clothing, and a roof over one's head

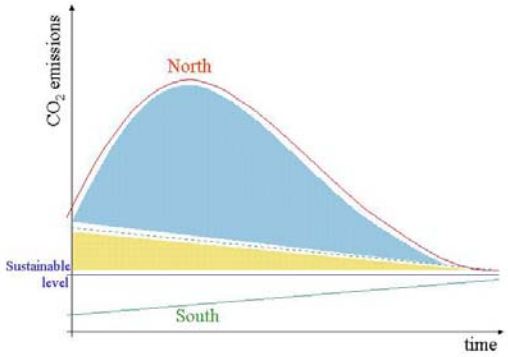
Figure 7. Possible combinations of 'ecosystems services' and 'equity'. Examples are simply meant to illustrate the point in the text.

1.3.4.4. *Is ecological debt a matter between countries; or who are the debtors and the creditors?*

Above, it has been stated several times that the current research project concentrates on ecological debt of countries. In the NGO campaigns industrialised countries are considered debtors, developing countries are considered creditors. It has been shown through analysis of several articles that it can be argued that also future generations can and should be considered creditors. When e.g. the North is damaging and over-using global ecosystem services and goods (such as the sink capacities of the atmosphere), the question is whether all of this ecological debt is due to the South. With two simplified models, it can be argued that part of the overconsumption is due to the South, while another part of it is a debt towards future generations.

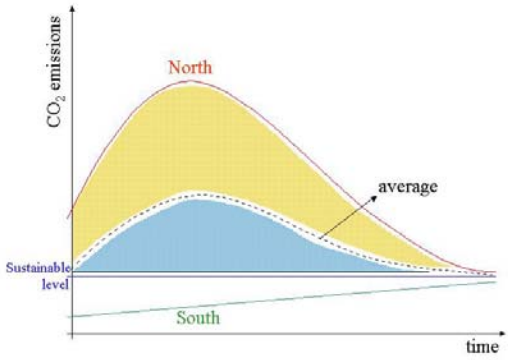
The problem of global warming can illustrate the models (see module energy/climate for more details). In this hypothetical case CO_2 emitters are divided in 'the North' (overconsumers of CO_2 absorption capacity) and 'the South' (underconsumers of CO_2 absorption capacity) and follow a path of contraction and convergence.

- Model 1: Here, it is argued that the North is in debt towards the South (inter-country debt) only in as much as the South is 'underconsuming' with respect to the sustainable level. In the figure below this inter-country debt has been indicated in yellow.



The rest of the Northern overconsumption (depicted in blue) is then regarded as debt towards future generations (intergenerational debt).

- Model 2:. The convergence point is again the sustainable level of CO_2 emissions, but here it is argued that consumers above the world *average* are in debt towards under-*average* consumers. The interstate debt is depicted in yellow in the figure below.



One could say that once this debt has been compensated for we are dealing with a notional average consumer ('this generation') who is overconsuming with respect to the sustainable level and thus could be regarded as being in debt towards future generations (intergenerational debt; indicated in blue).

These models are only rough drafts of how one could think about attributing debt in terms of interstate and intergenerational. Despite their simplicity they do show that dividing up total ecological debt between countries and between generations is not straightforward. Several choices are involved, such as what is a sustainable level of consumption of natural resources? Should the dividing line between inter-country and intergenerational debt be based upon overconsumption related to a sustainable level or to a world average (or another measure)?

As we showed above, some existing definitions of ecological debt do not only refer to countries but also to actors within countries ("industrialised countries, their institutions, banks, political and economic elite, corporations (…) and their allies in Southern countries",

Donoso 2002, 1-2). In this analysis, specific actors are debtors or creditors, and not or not only countries.

A possible way of specifying is by using concepts such as 'the global North' and 'the global South', or 'the globalised rich' and 'the globalised poor', but the problem is that these are not very clearly defined. The global North is the consumer class, "one third of which, roughly speaking, lives in North America, another third in Europe, and the last third in the South" (Sachs 2002, 83). The global South are people living in South and North who are excluded from the consumer class. This terminology resembles the older terminology of 'core' and 'periphery' (with a core and a periphery within the North and within the South as well). Debtors are the global North or the core, creditors are the global South or the periphery. When the analysis turns to actors, it becomes necessary to use the working definition of ecological debt, based on "entity A" (see 1.3.3.2.). As has been said, the limitations of the current research project do not allow to go deeper into the analysis at this point.

1.3.4.5. *How to quantify ecological debt?*

Until now, quantifications of ecological debt have been done primarily in monetary terms, but no agreed upon methodology has been developed. Another way of tackling the quantification problem can be to try expressing ecological debt in physical units. This seems essential anyway when one wants to monetise at a later stage. But quantification does not necessarily have to move on to monetisation. We think that in several contexts quantification in physical units can be enough to operationalise ecological debt. In climate negotiations e.g. carbon debt in CO_2 equivalents is enough to demonstrate the historical responsibility of industrial countries for the climate problem. We will return to the problem of quantification in 1.4.

1.3.4.6. *Since when have different forms of ecological debt been accumulated?*

Existing definitions usually state that ecological debt has been built up since colonial times. When one starts examining the topic in terms of ecological problems caused this is clearly too simple, in particular for global and continental environmental problems. Human interference with nature was not that important before the industrial revolution that it caused global environmental problems. But local, regional and fluvial problems have certainly been caused since colonial times. In principle, for each kind of ecological damage a specific time frame can be constructed.

Carbon debt can be considered as originating from the time of the Industrial Revolution (for further details, see part 4). For local forms of ecological debt the moment of colonisation is a relevant time perspective (disregarding of course the problem of calculating this debt).
However, some fundamental considerations have to be made:

- It should be realised that ecological debt is not only a historical issue; the ecological debt is increasing day by day and in some cases is sure to increase for another dozens of years (e.g. carbon debt).
- Ecological debt implies intergenerational issues. But, on a societal level, there are no distinct moments in time when one generation leaves and another takes over. What is the time span of one generation? A crucial moral question is at stake here: Can debt be inherited? I.e. are we responsible for the deeds of our ancestors? As an argument in favour

it could be mentioned that who we are and what we have (in terms of wealth,…) is also the result of our history; we enjoy the riches of our past (Barkan 2000, 344).

- The year from which one chooses to quantify the ecological debt may also depend on pure practical considerations such as the availability of relevant data. In any case, an ecological debt should always be expressed in a 'debt since' e.g. the ecological debt of Belgium since 1830.
- Another problem with the time perspective is that the further one goes back in history, the more difficult it becomes to allocate ecological debt to specific countries. Belgium did not exist before 1830, so it is difficult to allocate ecological damage before 1830 to the state Belgium. Should all of this damage then be allocated to countries such as Spain, Portugal, England, France, the Netherlands?

1.3.4.7. Overview of possible refinements to the working definition

Stipulative definition / working definition	**Possible refinements of the stipulative definition**
"The ecological debt of country A consists of (1) the ecological damage caused over time by country A in other countries through its production and consumption patterns, and/or (2) the ecological damage caused over time by country A to ecosystems beyond national jurisdiction through its consumption and production patterns, and/or (3) the exploitation or use of ecosystems and ecosystem goods and services over time by country A, at the expense of the equitable rights to these ecosystems and ecosystem goods and services by other countries or individuals."	Refinement for ecological damage: • According to type of interference: pollution, depletion, degradation
	Refinement for spatial scale of ecological damage: • Distinction between global, continental, fluvial, regional, local
	Refinement for ecosystems and ecosystem services: • According to type of ecosystem and service provided
	Refinement for equitable rights: • Different interpretations of 'equity' for different ecosystems and ecosystem services
	Refinement for actors (debtors and creditors) • Countries • present and future generations • Classes within countries (e.g. globalised rich, globalised poor) • Actors such as companies
	Refinement for quantification: • physical units • monetary units
	Refinement for time: • for each category of refinements, a time perspective can be constructed

Since we stated above that refinement of a general definition of ecological debt is probably necessary in an international policy context, we tried to test some of the refinements in the modular research. The following refinements will be tested:

- For ecological damage: refinement will be sought according to type of interference;
- For spatial scale: in order to make the picture not to complicated, we will not distinguish between five spatial scales, but group them into 'global/continental' and 'fluvial/regional/local'
- For equitable rights to ecosystem goods and services: we will start from an egalitarian approach

- For debtors and creditors: we will make calculations for countries and try to refine allocation of ecological debt between countries and between present and future generations
- For quantification: the research will concentrate on quantification in physical units; based on previous research, some monetary calculations will be performed
- No refinements will be made for the time aspect; refinement will depend on data availability

1.4. Measuring ecological debt: elements for a consistent methodology

1.4.1. General overview of the methodology

Since the research project wants to present figures for Belgium on ecological debt, we have to be able to measure the different components of the working definition: firstly, the ecological damage caused in other countries and secondly, the use of ecosystems and ecosystem services at the expense of other countries or individuals (even without damage being caused).

Several methods for calculating components of ecological debt were identified during the project. Figure 8 gives an overview of methods and of the way they are connected. The basis of the methodology are physical quantification methods. Once a physical quantification has been performed, a next step can be to valuate 'physical' ecological debt in monetary terms.

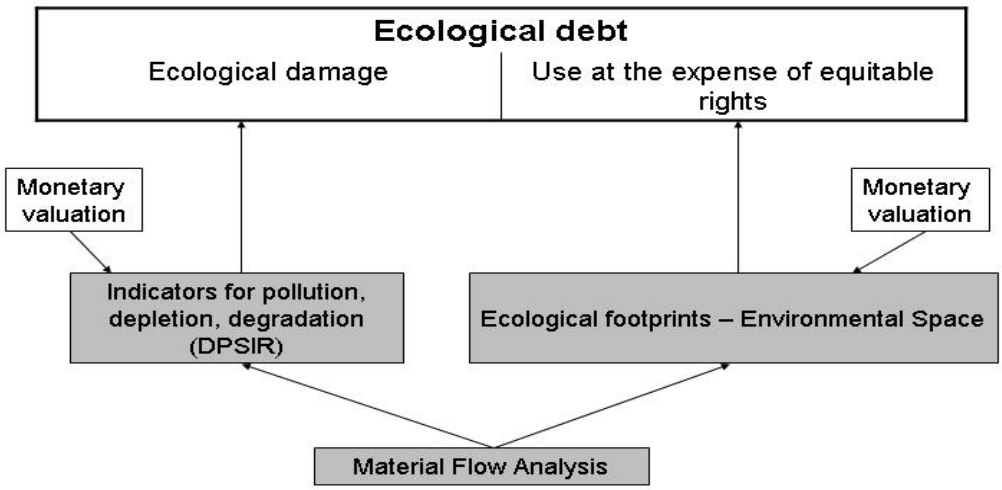


Figure 8. Methodology for calculating ecological debt in its physical and/or monetary aspects. Biophysical accounting systems form the basis, monetary valuation is an optional next step.

For quantifying the *ecological damage aspects of ecological debt*, a range of indicators will be necessary. These may be classified by using the DPSIR framework (1.4.2.). In addition to

indicators, a form of Material Flow Analysis (MFA) (1.4.5.) is necessary, since the methodology has to be able to trace ecological damage caused by country A *in other countries*. Information which has to be provided by MFA includes: Total Material Requirement (TMR) and/or Direct material Input (DMI) of (sectors of) the economy of country A; the composition of this (sectoral) DMI/TMR; the country of origin of the flows in (sectoral) DMI/TMR; the evolution over time of this (sectoral) DMI/TMR.

For quantifying the *aspect of 'use at the expense of'* two possible methods were identified: ecological footprint (1.4.3.) and environmental space (1.4.4.). Both of these methods are often interpreted as working with an 'equal per capita' (egalitarian) approach, so that these methods might seem to imply a preference for an 'equal' interpretation of 'equitable'. In fact, other interpretations are possible.

This is shown in footprint analysis in the concept of 'ecological deficit', which refers to the amount by which a country's ecological footprint exceeds the locally available ecological capacity. This interpretation of overuse is clearly *not* based an equal per capita entitlements of carrying capacity, but on what may be called a 'sovereignty' approach to equity: the right to consume is based on a country's carrying capacity; area (global hectares) used outside the country's territory leads to an ecological deficit. An egalitarian approach of ecological deficits would have to be based on what in footprint analysis is called 'fair earth shares': the total available productive land and water area is divided on a per capita basis. Ecological deficits are then calculated as the appropriated carrying capacity in global hectares in excess of per capita entitlements.

The same type of reasoning can be applied to the Environmental Space concept. The concept was originally coined by Hans Opschoor in the eighties. For Opschoor, environmental space "reflects that at any given point in time, 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" (Opschoor 1994). He states that this space has to be shared with present and future generations and with other species (Opschoor 1995, 17). The concept gained most attention in the second half of the nineties through the campaign and research from Friends of the Earth Europe and the Wuppertal Institute. The FoE/Wuppertal interpretation links environmental space to an egalitarian (per capita) view on equity, although as has been shown above, even here 'equal per capita' is not always interpreted as 'equal per capita on a global scale'. This interpretation is followed for energy and non-renewable raw materials, but wood and agricultural products are calculated on a per capita continental basis. Finally, water is considered a regional resource. In principle, this formulation of environmental space can be linked to different operationalisations of equity. As De Jonge e.a. (2002) have shown, different interpretations of equity, together with different interpretations of acceptable risks and preferences can significantly alter the results of available environmental space.

In general, on the basis of the current research, the environmental space concept is deemed to be better fit for calculations of ecological debt than the ecological footprint concept. The main reason is that the aggregation of all ecological pressures to global hectares turns ecological footprints into a very rough indicator, not suited for detailed calculations. The big advantage of environmental space is that it counts CO_2 in CO_2, tons of materials in tons, litres of water in litres, etcetera. Still, some components of the ecological footprint (e.g. 'cropland footprint', 'grazing footprint', 'forest footprint', 'fishing ground footprint') are interesting for studying space-related aspects of ecological debt.

Again, as is the case with the ecological damage aspect of ecological debt, MFA will be a necessary complement for calculating several aspects of 'use at the expense of'. In the modular research on agriculture will be shown how MFA is necessary prior to calculations on use of arable land abroad for fodder crops.

After physical calculations have been done, it becomes possible to make a monetary valuation of physical ecological debt. Several techniques from neoclassical environmental economics can be used. We do *not* think monetary valuation is a necessary step for all aspects of ecological debt. Policy implications can also be drawn from physical calculations: emissions of CO_2 or figures on land use abroad and coupled pollution (e.g. through fertiliser and pesticide use) can guide policy reforms in fields such as energy/climate or agriculture (see modular research and part on policy recommendations). Of course, monetisation adds additional information and – as has been mentioned above – there is the 'cultural soup' argument: the language of money easily draws attention. In some cases, monetisation will be necessary, e.g. when ecological debt has to be used as a counter-argument to external debt. In other cases, physical and monetary calculations of ecological debt can be complementary: in the modular research on climate/energy will be shown how a combination of physical and monetary calculation of carbon debt can be useful in the discussion on compensation for inter-country and intergenerational carbon debt.

In the next paragraphs, we discuss in some more detail the different quantification methods and add some further comments on strengths and weaknesses. In 1.4.7. some conclusions will be drawn.

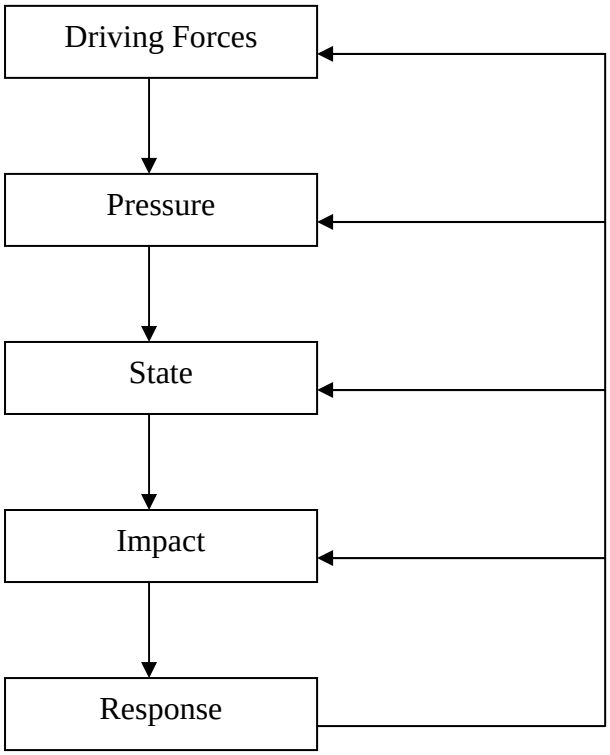
1.4.2. Systems of indicators

A much employed method for measuring ecological damage, is through the use of systems of indicators. In this case, it is necessary to select indicators which describe the three identified categories of ecological damage: pollution, depletion, degradation.

A possible method for classifying these indicators, is by using a typical instrument of environmental analysis, i.e. environmental cause and effect chains (Cörvers and Slot 1998, 26-30). In these chains, the relation between society and environment is analysed in a chain of successive phenomena. A much-employed model is the DPSIR model, which is used amongst others by Eurostat and the European Environment Agency (EEA) for analysing environmental problems and developing appropriate indicators. The different components of the DPSIR model are (Shah 2000, 6-7):

- Driving Forces: underlying factors of environmental problems, i.e. social, demographic and economic developments in societies and the corresponding life styles and overall levels of consumption and production patterns. These are usually analysed according to basic sectoral trends, such as trends in energy generation, transport, industry, agriculture, tourism
- Pressures: the human interferences or activities directly affecting the environment, i.e. pollution, depletion, damage. The pressure component of the model gives information on emissions, application of chemical and biological agents, the use of land and other resources.

- State: the current condition of the environment. The State gives information on the level, quality and/or quantity of physical and chemical phenomena in a given area at a certain point of time
- Impact: the effects of change of the environment on human health and the economic and social welfare of a society
- Response: efforts of society (different actors) to solve the problems. The response component refers to the reaction of the government, institutions, groups of people and individuals to undesired impacts on the environment. Responses can intervene at the different components of the chain.



A model such as DPSIR can be examined from two angles. A first possibility is to start from human activities and examine which impacts they have. A second possibility is to look at undesired consequences/impacts and look backwards at possible causes.

A weakness of a model such as DPSIR is that it suggests a linear relationship in the interaction between human activities and environment, while in reality most environmental problems have highly complex cause and effect relations. Consequently, opinions on what can be considered cause and effect may differ a lot. Still, we think it can serve as a good approximation of refining the general definition 'ecological debt = ecological damage'.

As has been mentioned above, an important complication is the fact that it is necessary to identify environmental damage in *other* countries or to ecosystems beyond national jurisdiction, *caused by* production and consumption patterns *in country A* (e.g. Belgium). An analysis of material flows between countries (see also 1.4.5.) will be indispensable in order to trace the origin and composition of material flows to country A. Necessary questions are

- where do these materials come from?
- what is the ecological damage caused by them in the country of origin?
- which part of it is due to country A?

Let us take as an example the ecological damage in other countries from fossil fuel exploitation for Belgian consumption. Steps to determine this damage, include:

1. composition of the flow of fossil fuels imported in Belgium
2. tracing of the countries of origin of the different fuels
3. suppose we want to further analysis natural gas: an important part of it comes from Algeria (see module climate/energy)
4. identification of indicators to describe the ecological damage in Algeria due to gas exploitation
5. how much of this damage is attributable to Belgium? e.g. a percentage equal to extraction for Belgium

The same kind of procedure can be followed for damage to ecosystems *beyond national jurisdiction*: after the material flow analysis, it is necessary to identify indicators to describe the ecological damage to different ecosystems and to calculate how much of this damage is attributable to Belgium, e.g. a percentage equal to extraction

The strength of the DPSIR approach is that, in theory at least, a detailed description of ecological damage is possible. A clear weakness is that it is impossible to describe all impacts. It will be necessary to select some important categories of impact/damage and concentrate calculation efforts on them. Probably some case studies will be necessary. Further, it will be necessary to investigate whether it is possible to get an idea of ecological damage, accumulated over time.

1.4.3. Ecological footprint

Ecological footprints can be an indicator for the 'use at the expense of' element of ecological debt. Due to the high degree of aggregation (the impact of a country is described in one measure, 'global hectares' or 'area units'), the ecological footprint can be considered as an indicator for use of the ecosystem earth or the biosphere at the expense of others.

The concept of ecological footprints was developed by Rees and Wackernagel (1992) and is one of the most influential physical accounting methods. The ecological footprint can be defined as the total land and water area required to support a population with a specific lifestyle and given technology with all necessary natural resources and to absorb all their wastes and emissions for an indefinite length of time (Wackernagel M., W. Rees, 1996). By comparing the land appropriation of the population of a country with the ecological capacity available within the national territory, sustainability deficits or surpluses can be quantified. When a country's ecological footprint is larger than its available ecological capacity, it must 'import' carrying capacity from elsewhere and/or deplete its natural capital faster than it can be replenished. It achieves this by actually importing food, fuel or forestry products or by running down its supply of renewable and non-renewable resources (e.g. fossil fuels). It may also 'export' wastes such as carbon dioxide emissions in excess of what its vegetation and surrounding oceans can absorb.

The most recent data show that the global ecological footprint covered 13,7 billion hectares in 1999, or 2,3 global hectares per person (a global hectare is 1 hectare of average biological productivity) (WWF 2002, 4). But the available productive capacity of the biosphere was only about 1,9 hectares per person. Low income and middle income countries have an average footprint which remains under or around that figure (average footprints of respectively 0,83 and 1,99 global hectares per person), high income countries go far above it (6,48 hectares per person). Total human consumption of natural resources overshoots the earth's carrying capacity by about 20%. "It is apparent that, since the 1980s, humanity has been running an ecological deficit with the Earth" (ibid).

An individual country's per capita ecological footprint may be compared to the size of that country's carrying capacity or to a world average. A comparison of per capita footprints to each country's available ecological capacity shows that a geographically large and sparsely populated country like Canada has a larger biocapacity (14,24 global hectares per capita) than its actual ecological footprint (8,84 global hectares per person). On the other hand, densely populated Bangladesh with an ecological footprint of only 0,53 hectares per capita has an even smaller carrying capacity of just 0,30 hectares per person. The figures for Belgium/Luxemburg (1999) are: ecological footprint of 6,72 global ha/person, biocapacity of 1,13 global ha/person and an ecological deficit of 5,59 global ha/person.

Wackernagel and Rees themselves (1996) already indicated that the high material standards of the so-called rich countries "are maintained by a massive but unaccounted ecological deficit with the rest of the word". The concept of 'ecological deficit' can be the basis for the physical quantification of ecological debt. As has been said above, ecological deficit is based on national carrying capacity. As Torras shows, ecological deficit can also be used to identify creditor countries (Torras 2003, see also 1.2.4.5.). In earlier publications, the concept of 'fair earth share' was also used, but this seems to have disappeared from the analysis[22]. The fair earth share is the available ecological space per person, after subtracting 12% of globally available space for the preservation of the 30 million non-human species that share our planet (a figure that was suggested in the Brundtland report). This brings the available space for humans to around 1.7 hectares per person (or the fair earth share). Fair earth shares could be a basis for an egalitarian approach to ecological debt calculations.

One of the strengths of the footprint concept, is its communication capacity. An ecological footprint calculation of ecological debt will be recognisable and understandable for a wide audience. Besides, the methodology is more or less fixed, it has gained some recognition in policy circles and it also regularly used in scientific analysis.

An important weakness is the high degree of aggregation. The ecological footprint can be considered as an indicator for use of the ecosystem earth or the biosphere at the expense of others. More specification is possible through the use of the components of the footprint, i.e. 'cropland footprint', 'grazing footprint', 'forest footprint', 'fishing ground footprint' and 'energy footprint'. These may be interesting for studying space-related aspects of ecological debt, although discussion remains over translation of in particular CO_2 to global hectares.

Another problem is the usefulness in time series, and thus the historical aspects of ecological debt. Global time series until 1960 have been made in WWF 2002. More detailed analysis has

[22] It is e.g. no longer to be found in WWF 2002 or on the website of the Global Footprint Network (www.ecofoot.net), the organisation started by Wackernagel and colleagues in order to coordinate research and develop methodological standards for footprint analysis.

been performed for Austria in Haberl H. e.a. (2001). The critical point of translating use in global hectares is important: "Our study suggests that although it is feasible to calculate footprints of nations in a long time-series, it is not straightforward to interpret the results. Currently used methods are useful to demonstrate local availability and appropriation of biocapacity for one point in time (…) The underlying reason is that the amount of product that can be produced on one hectare varies not only in space, but also in time. Different conventions to consider these variations are conceivable – we have empirically demonstrated three of them – which, however, have implications for the interpretation of EF, BC, and 'overshoot'." (44)

1.4.4. Environmental space

The concept of environmental space can be used as an indicator for the aspect 'use at the expense of equitable rights' of ecological debt.

The environmental space concept was introduced in the literature of sustainable development by Dutch scientists (e.g. Hans Opschoor) during the eighties. The Western European environmental movement (e.g. Friends of the Earth) spread it among a broader audience, with scientific support from the Wuppertal Institute. The study *Towards Sustainable Europe* is one of the results of this work (Spangenberg 1995a). Generally, the calculations are kept relatively simple and are based on a selection of assumptions concerning the pressures nature can stand and some targets considering the equity of resource-distribution.

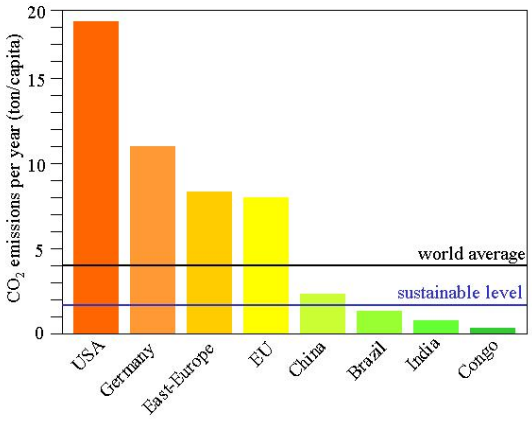
In the FoE/Wuppertal interpretation of environmental space, the concept is based on two principles (Rochol M., 2001):

- "On the simple fact that the Earth can only sustain a certain amount of pollution and use of resources. If we want to avoid a climate disaster, we can only put a certain amount of CO_2 into the air. If we want to preserve the forests, we can only fell a certain amount of timber. If we want future generations to have the same chances as we do, we have to reduce the use of non-renewable resources to the absolute minimum".
- "The second principle is the equity principle: Every person in the world should have the same right to use resources of the Earth." This implies that usage of the concept presupposes an 'egalitarian' view on equity, in the language which was used above (see 1.3.4.3.)

Starting from these two assumptions it is possible to calculate how much resource use is actually available for every person in the world. This is called environmental space. In practice, FoE/Wuppertal calculate environmental space for energy, non-renewable raw materials, agricultural land, wood and water.

Looking at the case of CO_2 emissions makes clear how the concept of environmental space can be brought into practice. The average person in the world is currently producing approximately 4 tons of CO_2 per year. In 1990 the United Nations Intergovernmental Panel on Climate Change (IPCC, 1990) suggested that a minimum 60% reduction on current CO_2 emissions is required in order to stabilise the world's climate. This sustainable level is an estimate based on a 'no regret policy' and taking into consideration a considerable number of remaining uncertainties. Taking population growth into consideration, the sustainable level is about 1.7 tons CO_2 per person per year. An average person in the USA produces almost 20

tons of CO_2 per year, an average European 8 tons. At the same time, developing countries still have some room to increase their CO_2 emissions.



Source: Rochol (2001)

Looking at the per capita CO_2 emissions of different regions of the world, it is clear that industrialised countries have been overusing their environmental space since at least 50 years. Today, in Europe every person is emitting about 5 times more CO_2 than someone in Africa and almost 3 times more than in Latin America. US citizens produce 18 times more CO_2 than Africans. Latin America and China are already overusing their environmental space since several years, even though they are still very much below the world average. People in Africa, as well as Asia (without China) are still living within their environmental space.

At this point the concept of ecological debt can be introduced as the overconsumption of environmental space, both in the past and in the future. Environmental debt would, for example, result from the amount of CO_2 which industrialised countries have put into the air and which are now causing global warming.

Ecological debt can of course be extended to many other areas. It includes the environmental damage resulting from all kinds of resource over-use by the North. Again, environmental space is helpful here, since a multidimensional environmental space can be constructed – and thus a multidimensional ecological debt. In contrast with the ecological footprint concept, aggregation is not the first goal of environmental space. Each 'space' is calculated according to its own 'measure': CO_2 in CO_2, tons of materials in tons, litres of water in litres, etcetera. Overshoot of these 'spaces' make up different dimensions of ecological debt. It is clear that a comprehensive calculation of all imaginable spaces is virtually impossible. Calculating ecological debt using environmental space demands a debate on which dimensions are relevant for measuring.

In an extensive research project at the Centre for Sustainable Development, aimed at the practical application of environmental space in decision making, De Jonge et al. (2001) made clear that uncertainties, differences in risk-perception and different viewpoints on equity can alter the results. Several refinements were suggested by De Jonge e.a. (2001), e.g. the use of fuzzy standards and fuzzy modelling for the dimensions of environmental space[23] and the use of differentiated values for these standards: target values (the boundaries of environmental

[23] With sharp standards a distribution of 50/50 would be perfectly equitable, while a distribution of 49/51 is perfectly inequitable. Fuzzy standards allow for a more subtle approach.

space and the targets to be aimed at), guide values (intermediate targets for policy; planned policy regularly reformulates these values in the direction of the target values and away from the limit values), limit values (absolute lower limits)[24].

A strong point of the environmental space concept is its relative ease of communication, as the FoE campaigns have shown. The concept is also often implicitly used, without using the term itself, e.g. in discussions on climate. The Sustainable Europe study (Spangenberg 1995a) has fixed a certain methodology which can be further elaborated upon through the application of e.g. fuzzy logic and differentiated values for standards. This would open up a possibility for weighing lack in knowledge, differences in perceptions of equity, differences in perceptions of risk. As far as we are aware of, there are no applications in time series.

1.4.5. Forms of Material Flow Analysis

Weight-based material flow indicators are not a direct measure for ecological debt, neither for the ecological damage aspect, nor for the use aspect. Still, they provide necessary information – in addition to financial trade balances – to trace the places on which (Belgian) consumption and production patterns have impact.

In the last fifteen years, several approaches have been developed that provide comprehensive information on the relations between socio-economic activities and resulting environmental pressures in biophysical terms. The principle concept underlying economy-wide Material Flow Analysis (MFA) approach is a simple model of the interrelation between the economy and the environment, in which the economy is an embedded subsystem of the environment and – similar to living beings – dependent on a constant throughput of materials and energy. Raw materials, water and air are extracted from the natural system as inputs , transformed into products and finally re-transferred to the natural system as outputs (waste and emissions). To highlight the similarity to natural metabolic processes, the term 'social metabolism' (Fisher-Kowalski M., 1998) has been introduced.

Material flows resulting from international trade are mainly accounted for as direct import and export flows in terms of their weight. In addition, some studies also account for material flows, which are not physically imported, but were generated abroad in order to enable the production of the imported goods (so-called hidden flows associated to imports). Also flows of waste and emissions can be considered as indirect material flows related to the production of traded goods. Several methodologies for measuring material flows, taking into account certain indirect flows, have been introduced. One of these approaches that gained intensive echo in the scientific community was developed at the Wuppertal Institute in Germany and was elaborated by the Centre for Sustainable Development on a regional level for the case of Flanders (MIRA-T, 2001 & 2002). This methodology focuses on the material inputs that form the material base of every human activity. According to this methodology the Total Material Requirement (TMR) of a socio-economic system comprises the cumulative volume of primary materials which are extracted from nature for the economic activities of a country. TMR is an indicator for the material basis of an economy. It includes extraction from the domestic territory as well as the resource requirements associated with imports. TMR considers resource extractions for further processing (Direct Material Input, i.e. DMI) as well as the Hidden Flows (HF), that is, those extractions which are not used further but

[24] Dutch translations are respectively 'streefwaarden', 'richtwaarden' and 'grenswaarden'.

nevertheless burden the environment (overburden, extraction waste). These hidden flows do not enter the economic system, but can have wide ranging negative consequences for the local populations, who depend on the environmental quality for their own reproduction and for future economic activities. The relation between foreign and domestic parts of TMR indicates possible shifts in environmental burden between countries.

Direct physical trade flows inform mainly about the global redistribution of natural resources as direct physical inputs to the socio-economic systems of countries and regions. While trade relations between two countries or world regions may be balanced in monetary terms, they may at the same time be characterised by a substantial inequality with regard to the flows of natural resources. Thereby, some regions may systematically drain off ecological capacity from others by importing resource intensive products and exporting wastes (Andersson and Lindroth, 2001). But even if direct physical imports and exports are balanced between trading partners, distribution can still be unequal with regard to indirect flows "embodied" in traded goods. Physical accounting can thus serve as a suitable framework for the analysis of environmental distribution issues in international trade relations. Moreover, by taking into account indirect flows it is regarded as viable method to account for ecologically unequal exchange (Giljum S., 2003) (see also 1.5.2).

From the point of view of ecological debt, MFA is necessary to trace possible impact abroad and the magnitude of this impact. MFA can e.g. make clear in which countries impact will be situated, which resources are made use of in these countries, what the volume is of this use, what the evolution is over time of composition and volume. While MFA is a booming scientific field, some methodological shortcomings should however be kept in mind: the unavailability of adequate data, especially on indirect flows; the high degree of aggregation of most MFA indicators (like TMR) which do not allow assessments disaggregated by economic sectors or products and the fact that qualitative aspects (like the potential for environmental harm) of different types of material flows remains unconsidered. The modular research on energy/climate and agriculture/food supply will make clear how we have tried to deal with some of these shortcomings.

1.4.6. Monetary quantification

Monetary valuation of environmental goods and services or of environmental damages is a much discussed topic in environmental economics and ecological economics. The purpose of monetary valuation is to put a price on environmental services and damages and in thus to provide information on the value of the environment, in particular when decisions have to be taken with consequences for the environment (e.g. investments in infrastructure). Many environmental resources are not bought and sold in the market; they are just used. Environmental economists hope that attaching a price tag to the environment will – at least partially – remove the bias towards economic activities that downgrade the environment. It will also make it possible to compare economic benefits with environmental benefits and costs.

Of course, sometimes markets exist. An example is the emerging market in CO_2 credits (or better: CO_2 equivalent credits). Under the Kyoto Protocol, three mechanisms have been created to trade emissions: tradeable emissions permits, Joint Implementation and the Clean Development Mechanism. Although the Protocol has not yet entered into force, several governments and firms are already active in the market and have started to trade.

The transactions are usually grouped in two main categories (Lecocq 2004, 9). The first are project-based transactions, in which the buyer participates in the financing of a project which reduces GHG emissions compared with what would have happened otherwise, and gets emission credits in return. This category covers transactions under CDM and JI, and most of the volumes of trades happen in this group. Buyers are heavily concentrated: Japanese companies, the World Bank Carbon Finance Business and the government of the Netherlands account for nearly 90% of the demand in 2003-2004. In the same period, two thirds of the supply in terms of volume came from five countries (India, Brazil, Chile, Indonesia and Romania) (ibid., 3). The average price of credits increased from $4.88 (end of 2003) to $5.52 (mid-2004). The second category of transactions are trades of emission allowances, which are created and allocated by a regulator, usually under a cap-and-trade regime. Allowance markets are still in their infancy. An important development is the approval of the European Trading Scheme (ETS) within the EU, which from January 2005 onwards will create the single largest market for GHG emission allowances (ibid., 31). Trading has been minimal until now, with the price fluctuating between 6 Euro per ton CO_2 equivalent (tCO_2e) and 12 Euro/tCO_2e (ibid., 32).

All prices mentioned are the abatement costs for a ton of CO_2e, or the cost incurred when reducing GHG emissions. These prices can fluctuate, depending on market conditions. E.g. prices will be low when the commitment to reduce (the demand for reductions) is low or when the supply of projects in the south and east is high. “The higher and quicker the commitment to reduce, the higher the marginal cost of the reduction” (Martinez-Alier 2002), and thus the higher price. A monetary valuation of carbon debt, based on the abatement cost of CO_2, will clearly be influenced by these market conditions.

Furthermore, these prices for CO_2 only tell which costs companies and projects face, under current market conditions, to reduce their emissions. They do not tell anything about the value of the damage caused by over-emission of CO_2, or the value of the damage avoided by not emitting. When no market prices are available, the problem of monetary valuation becomes much more complicated.

Environmental economics has developed several tools for assessing these values. Most of them are based on the concept of ‘willingness-to-pay’ (WTP) or ‘willingness-to-accept’ (WTA). WTP is the amount of money an individual is willing to pay to obtain a benefit (e.g. a national park, or cleaning up of a polluted river) or avoid a loss (e.g. some form of environmental deterioration). WTA is the amount of money that an individual is willing to accept as compensation for suffering a loss or for not receiving a benefit. In most studies, WTP is preferred to WTA. The idea behind WTP is that in markets, preferences show up in the decision to buy or not to buy goods and services at a certain price. When there are no markets, “it is necessary to elicit preferences through hypothetical markets, for example by asking what people are willing to pay (...) In principle, the we can measure preferences by what people are, or say they are, willing to pay. This willingness to pay is a measure of economic value” (Pearce and Barbier 2000, 8). Valuation techniques are divided into (ibid., 62-70):

- Revealed preference approaches: values are obtained by looking at WTP in market places that involve the environmental impact in question. E.g. the price of houses is affected by the characteristics of the house itself (number of rooms...), but also by characteristics of the environment (noise and air pollution, park nearby...). Price differences – other things

being equal – then give an indication of how these environmental characteristics are evaluated

- Stated preference techniques: values are elicited through some form of questionnaire approach. The best known example is the contingent valuation method. Survey questions are used to elicit people's preferences by asking them how much they are willing to pay for environmental improvements or to avoid damage. A famous example was used in the law suit against the Exxon company, following the oil spills by the oil tanker Exxon Valdez in Alaska.

Are these kind of techniques useful for monetising ecological debt? Monetary valuation is controversial because is presupposes the ethical basis of neoclassical economics: preference based utilitarianism, consumer sovereignty (Common 2003, 3). But apart from the considerable debate over the value and the usefulness of these techniques, the least that can be said is that they give additional – albeit partial – information, alongside a physical description of ecological debt. In some cases this can be useful or even necessary. Daniela Russi (2003, 144-145) mentions several reasons why a monetary translation of ecological debt can be useful: the financial language is a language which is continually used on business and institutional level; financial evaluation of environmental liabilities is useful in a judicial context; it can be the only way of ensuring that victims of damage receive a compensation and that the crime does not remain unpunished; it can be a way of redistributing earnings from the contaminating activity; it can work as an incentive not to start polluting or al least to take precautions; financial compensation also has a strong symbolic value and reaffirms the rights of local populations over their territory. She also mentions some caveats: financial compensation should be carefully managed so as not to create imbalances within the receiving community; it should be sufficiently high so as not to be interpreted as a pollution permit; it often compensates the poor poorly since it often reflects the existing power structure; much environmental damage is irreversible and cannot be repaired. What can be added to these arguments is that in some cases monetary valuation is probably necessary, e.g. when ecological debt is used as a counterargument to financial debt.

1.4.7. Interim conclusions and remaining questions on measuring ecological debt

Until now, there has been no systematic research into a methodology for measuring ecological debt. Starting from the working definition and its two main components – ecological damage and use at the expense of equitable rights – it is possible to set up a methodology. The basis for this methodology are physical accounting systems: a set of indicators to describe ecological damage (pollution, depletion, degradation) and environmental space or ecological footprints to describe use. Material flow analysis is a necessary foundation underneath these systems, since the methodology has to be able to trace impacts abroad. A monetary valuation is a possible next step.

Physical and monetary quantification are complementary. Monetary valuation is *not* a necessary step for all aspects of ecological debt. Policy implications can also be drawn from physical calculations: emissions of CO_2 or figures on land use abroad and coupled pollution (e.g. through fertiliser and pesticide use) can guide policy reforms in fields such as energy/climate or agriculture (see modular research and part on policy recommendations). Of course, monetisation adds additional information and – as has been mentioned above – there is the 'cultural soup' argument: the language of money easily draws attention. In some cases,

monetisation will be necessary, e.g. when ecological debt has to be used as a counter-argument to external debt. In other cases, physical and monetary calculations of ecological debt can be complementary: in the modular research on climate/energy will be shown how a combination of physical and monetary calculation of carbon debt can be useful in the discussion on compensation for inter-country and intergenerational carbon debt.

While a monetary valuation translates all impacts to one common denominator – money –, it is clear that a common physical denominator is not possible. Maybe in the future, when it has become normal to measure ecological debt, one can imagine several separate physical accounts which keep track of the debt in different ecological categories (e.g. an account for carbon debt, an account for land use abroad etcetera). Perhaps at that moment it will become necessary to ask whether trade-offs are possible between different categories, and whether this can lead to a debt-free situation.

For the moment, it might be a good idea to start calculating ecological debt for several countries, based on the same methodology – e.g. the one developed here and applied in the modular research – and thus to further the debate on the importance of ecological debt.

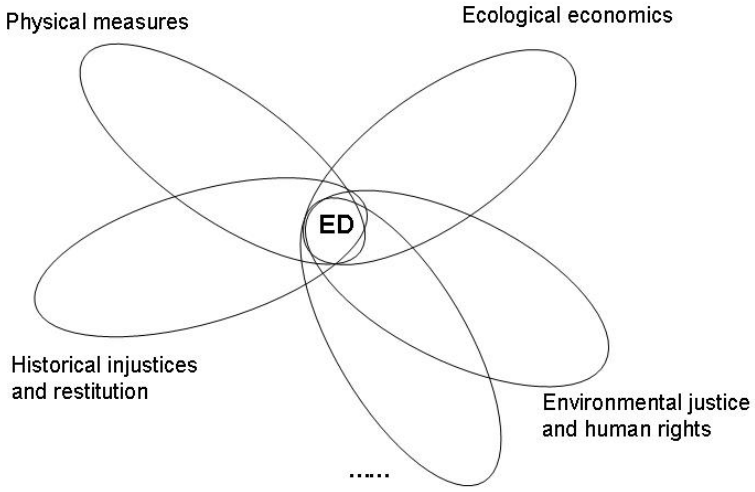
1.5. Frame of reference: building blocks of ecological debt

In the course of the research, it became clear that ecological debt is a concept that is situated at the intersection of a number of visions, or ways of looking at and interpreting the world. The formulation of this kind of concept presupposes several premises without which ecological debt is not even conceivable or thinkable. For example: a necessary premise for (some elements of) ecological debt is the idea that the carrying capacity of the earth is limited and that all people have equal rights to the use of (parts of) that capacity. Without this idea of limits and equal rights, it is senseless to speak of e.g. carbon debt. This paragraph of the report should make clear in what kind of 'world' ecological debt should be situated in order to make it a sensible and useful concept.

These visions may be referred to as the 'building blocks' of ecological debt and constitute a frame of reference for the concept (see also the figure). The main building blocks we have identified are:

- Biophysical accounting systems such as environmental space, ecological footprint, material flow analysis: a basic element underlying the concept of ecological debt is the notion of the limitedness of the carrying capacity of the earth and how it should be dealt with in an equitable way. Biophysical accounting systems are methods for quantifying these limits.
- Ecological economics: economic relations between countries and the interaction environment-economy are essential for understanding ecological debt. The developing branch of 'ecological economics' seems to be a more appropriate framework for analysing ecological debt from an economics point of view than neoclassical (environmental) economics
- Environmental justice and human rights: the idiom of environmental justice originated in the US in the struggle against the disproportionate allocation of environmental problems to coloured communities. The analysis of power and the language of rights typical of the environmental justice movement can be used as a tool for understanding the meaning of ecological debt and for strengthening the concept.

- Theories on historical injustices and restitution: what does history tell us about the restitution of past injustices; what is the role of 'recognition' in this context?



Further elaboration of these 'building blocks' may contribute in giving the concept of ecological debt a more profound base. Clearly, other building blocks can be added to complete the picture. Martinez-Alier (2002) elaborates on the concept of 'political ecology', which he defines as the study of ecological distribution conflicts, and which is thus closely linked to environmental justice. Agarwal and Narain used the language of 'eco-colonialism' to describe climate politics between North and South. Within the context of this research project, it was not possible to analyse all these concepts.

1.5.1. Biophysical accounting systems

The growing realization that there are limits to the availability of resources on the one hand and limits to the absorbing capacity of ecosystems on the other hand has an important impact on the historical and future course of human development. Crossing limits means endangering the global ecosystem and limiting others people's possibilities for development (now and in the future). Biophysical accounting systems provide ways of defining and understanding these limits.

We do not go into further detail here, since concepts such as ecological footprints, environmental space and material flow analysis have already been discussed in 1.4.

1.5.2. Ecological economics

During the nineties, a new branch of economics developed, the so-called 'ecological economics'. Proponents of ecological economics describe it as "a new transdisciplinary field of study that addresses the relationships between ecosystems and economic systems in the broadest sense. These relationships are central to many of humanity's current problems and to building a sustainable future and are not well covered by any existing scientific discipline(…)

By transdisciplinary we mean that ecological economics goes beyond our normal conceptions of scientific disciplines and tries to integrate and synthesise many different disciplinary perspectives" (Costanza et al 1991).

The emergence of ecological economics stems from a dissatisfaction with the conventional, neo-classical approach of economics and environmental problems (Deblonde 2001). Neoclassical economics interprets the economy as an isolated system in which exchange values circulate between firms and households. In this model, an economy is independent of its ecological environment. Competitive markets are able to realize optimal allocations of capital and labour. The value of commodities on the market are revealed through prices, which are an expression of individual preferences. Neoclassical environmental economics is a correction to this model, in that it understands nature as a resource for economic activities. The interface between economy and ecology remains external. Environmental problems are caused by a non-optimal allocation of environmental goods and services. By intervening in markets or by creating markets for environmental goods and services, problems of pollution or depletion can be tackled.

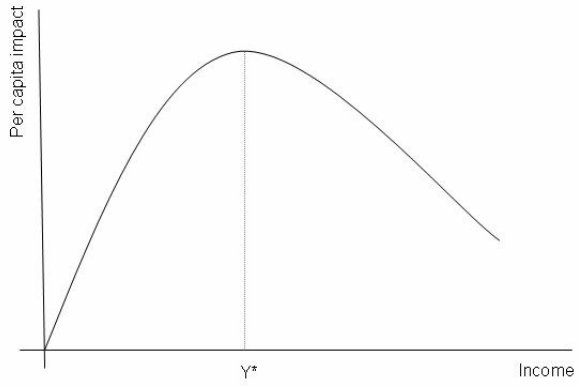
Ecological economics understand the economy as embedded in the ecosystem[25] and in an historically grown social reality. The basic points of consensus in ecological economics are (adapted from Costanza et al 1997):
1. the vision of the earth as a thermodynamically closed and nonmaterially growing system, with the human economy as a subsystem of the global ecosystem. This implies limits to throughputs of resources and discharge of emissions
2. a vision of a sustainable planet with a high quality of life for both humans and other species within the material constraints imposed by 1
3. a recognition of fundamental uncertainty in the analysis of complex systems like the earth, requiring a fundamentally precautionary stance
4. a need for proactive institutions and management, resulting in adaptive and implementable policies, based on sophisticated understanding of underlying systems and fully acknowledging uncertainties

Whereas neoclassical economics deals extensively with problems of allocation and to a smaller degree with problems of fair distribution, ecological economics addresses three basic problems: scale, distribution and allocation[26]. Allocation refers to the division of the resource flow among alternative product uses. Distribution refers to the division of the resource flow among alternative people. Scale refers to the physical volume of the throughput in the economy and may be thought of as product of population times per capita resource use. It is measured in physical units. Following Herman Daly, ecological economists often talk of full-world economics, meaning that the volume of the human economy has reached the limits of the earth's carrying capacity (or its environmental space). The human economy has passed from an era in which human-made capital was the limiting factor in economic development to an era in which remaining natural capital has become the limiting factor. Economic theory and policy should reflect this crucial point. A fundamental critique on neoclassical (environmental) economics is that allocative efficiency does not guarantee sustainability. A sustainable scale for the economy cannot be determined by prices, but should be a social decision reflecting ecological limits. Also distribution should not be determined by prices, but by a social decision reflecting a just distribution of assets. Subject to these social decisions, individualistic trading in the market is then able to allocate the scarce rights efficiently.

[25] Martinez-Alier specifies "the historically changing social perception of the ecosystem" (2002, 21)
[26] This paragraph follows the discussion in Costanza et al 1997

It may be clear that for treating economic aspects of ecological debt, the framework of ecological economics is much more suited than that of neoclassical (environmental) economics. In this respect, special attention is required for trade theory. Conventional trade theory calls for free trade, building on the so-called law of comparative advantages, first formulated by David Ricardo around 1800. Ricardo stated that countries gain from trading when they specialise in products in which they are comparatively more efficient. Trade promotes economic growth and welfare improvements in the exporter as well as in the importer country[27]. Since growth raises financial resources for implementing environmental policies and for investing in pollution-fighting technologies, neoclassical environmental economics believes trade will not harm the environment. Trade will even promote sustainable development when environmental externalities are internalised in prices.

From an ecological economics point of view, several critiques are formulated. First, the positive relationship between international trade and economic growth is doubted. Growth is measured in GDP, which is considered a misleading indicator by ecological economics. Second, the positive link between economic growth and the environment is disputed. The Environmental Kuznets Curve (EKC) is often used to illustrate this relationship. The EKC suggests that the intensity of the per capita environmental impacts of production falls after per capita income passes a certain threshold level, represented by Y*. The implication is that economic growth is favouring environmental protection, beyond a certain level of income (see figure).



An Environmental Kuznets Curve

As yet, there is little clear-cut evidence supporting the existence is of an EKC (Markandya et al 2002). Even if the EKC-hypothesis holds true, it might be dangerous for the South to follow the rule ‘damage the environment in order to grow, and the (with the revenues) cure it’ (Goodland and Daly, cited in Muradian et al 2001). The reason is that a lot of Southern environmental damage is irreversible loss of biodiversity and dispersal of minerals, both of which cannot be replaced.

Further complicating the picture is the fact that the EKC path in industrialised countries may be the result of international specialisation: “poor countries may attract ‘dirty’ and material

[27] The next paragraphs follow the discussion in Muradian en Martinez-Alier (2001)

intensive production while richer countries specialise in clean and material extensive production, without altering the consumption patter (ibid., 286). Data compiled by Muradian and Martinez-Alier suggest that Northern economic growth goes together with "(a) increasing consumption of non-renewable resources coming from developing countries; and (b) worsening terms of trade for exporting countries specialised in non-renewable resources (…) In this sense, Europe and the US, being net importers (in weight) for the most polluting sectors, could have an 'ecological deficit'[28], especially with developing countries."

This kind of evidence has given rise to the formulation of a theory on ecologically unequal exchange, which is defined as "the fact of exporting products from poor regions and countries, at prices which do not take into account local externalities caused by these exports or the exhaustion of natural resources, in exchange for goods and services from richer regions. The concept focuses *on the poverty and the lack of political power of the exporting region*, to emphasize the idea of lack of alternative options, in terms of exporting other renewable goods with lower local impacts, or in terms of internalizing the externalities in the price of exports, or in terms of applying the precautionary principle to new export items produced with untested technologies" (Martinez-Alier 2002, 214). This theory is in fact an addition to the Singer-Prebisch thesis formulated in the 1950's, which stated that due to their specialisation in primary products, developing countries economies will suffer from continuous deterioration of their terms of trade. The Singer-Prebisch thesis is based on monetary evidence, the theory of ecologically unequal exchange on physical flows, but as can be seen from the quotation Martinez-Alier adds a monetary element through the use of externalities.

In fact, there seem to be several interpretations of ecologically unequal exchange and several ways of measuring. Anderson and Lindroth (2001) give a slightly different interpretation when they state that exchange is ecologically unequal if there is an imbalance between imports and exports, calculated in ecological footprints. This kind of ecologically unequal exchange is the general rule, according to them. Still, they admit that it is important to recognise and measure it, because the unequal exchange can become unsustainable, meaning a continuous reduction of the ecological capital in at least one of the trading partners. "Trade can be a subtle mechanism by which ecological sustainability is preserved in some countries by means of importing biomass and sink-capacity from other countries, where the ecological capital is instead gradually depleted. It is the subtlety of the mechanism that makes it especially dangerous. There is no easy way to discover and to measure it" (ibid. 121). This is exactly what the concept of ecological debt wants to bring to the front.

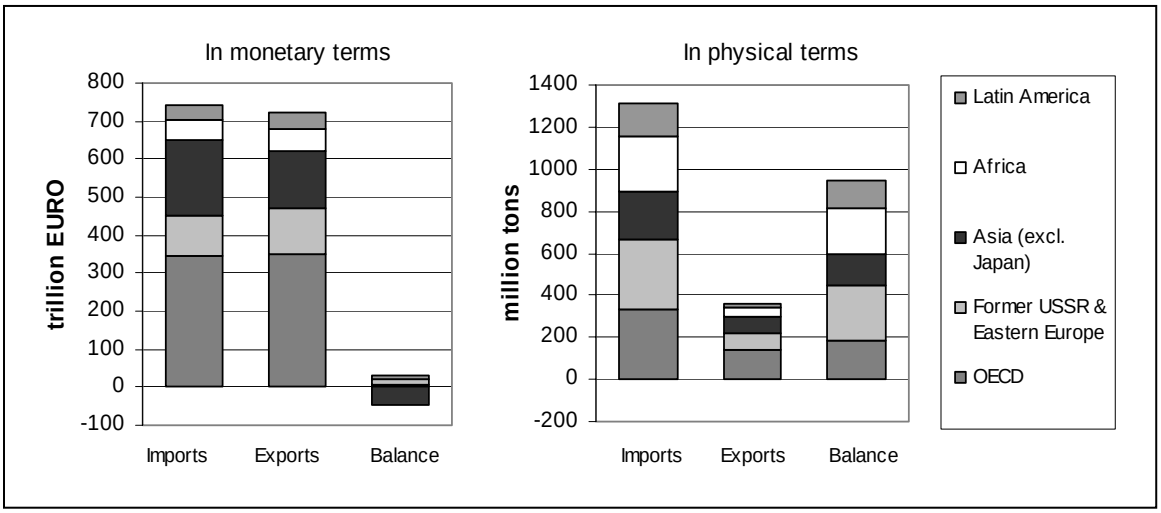
Still another way of measuring ecologically unequal exchange is through MFA and physical trade balances. Even when trade relations between two countries or world regions may be balanced in monetary terms, they may at the same time be characterized by an inequality with regard to the flows of natural resources. Thus some world regions may systematically benefit from the ecological capacity of other world regions by importing resource-intensive products and exporting wastes. "Physical trade balances for both countries and world regions in the core and in the periphery of the global economic system illustrate that core economies in general are characterized by an increasing physical trade surplus, meaning that their imports

[28] It is remarkable that the term 'ecological debt' is not used here. A possible explanation may be found in Ageyman et al (2003, 326) where it is stated that "today's unjust *ecological deficits* are the contemporary equivalent of the massive *ecological debts* (…) that the developed world has amassed historically.": yearly deficits accumulate into historical debts. Another explanation may be that 'deficit' refers to physical aspects (comparable to the ecological deficit used in footprint analysis), whereas ecological debt refers to the monetary equivalent.

of natural resources exceed their exports, whereas the reverse holds true for countries in the periphery. While the major share of raw material imports to core economies origin in the periphery, other core countries are the main destination of core economies' exports. Exports from the periphery are characterised by significantly lower prices per physical unit than exports from core economies. Although the analysis of physical flows does not allow assessing actual environmental impacts, our results support the hypothesis that economic specialisation in the globalisation process leads to an unequal environmental distribution between different world regions. It is argued that in addition to increasing environmental pressures, specialisation in resource-intensive exports also limits prospects for sustainable socio-economic development in the global South." (Giljum and Muradian, forthcoming)

Gijum and Muradian present an interesting figure which illustrates the significant structural differences of the external trade relations in monetary and physical terms. While the monetary trade of the European Union is more or less balanced (apart from a small deficit with Asian countries), physical trade is characterised by a large trade surplus with all other world regions (including the non-EU OECD countries). This is mainly due to the high import of fossil fuels (around 60% of all imports in terms of weight) and abiotic raw materials and semi-manufactured products (together around 20% of all imports). Crops and animal products are the only product group, in which the EU is a substantial net-exporter to some world regions (Africa, Asia, the former USSR and Eastern Europe) in physical terms. More than two thirds of EU physical imports originate in countries outside the OECD, whereas OECD countries are to a larger share the destination of EU exports. If the monetary flows are balanced, but a large physical surplus arises, prices of imports and exports must as well differ substantially.

Figure: External trade relations EU-15 in monetary and physical terms, 1999



Source: Giljum and Muradian (forthcoming)

The developing theory of ecologically unequal exchange seems to have important implications for the debate in industrialised countries on 'relative dematerialisation'. Instances of relative dematerialisation may in fact be illusions when the material aspects of production are dislocated to developing countries. In this way, trade may open up possibilities for industrialised countries to improve their environment without lowering the material and energy intensity of their consumption patterns.

1.5.3. Environmental justice and human rights

In the current debate on ecological debt, environmental justice and human rights are cited as possible languages with which to deepen the understanding of ecological debt. The concept of environmental justice originated in the United States in the 1980's. The traditional definition of environmental justice is "that certain minority populations are forced, through their lack of access to decision-making and policy-making processes, to live with a disproportionate share of environmental 'bads' – and suffer the related public health problems and quality of life burdens" (Ageyman et al 2003, 6). Minority populations are usually understood as people of colour. The environmental justice movement is then the organized movement against what is called 'environmental racism', or the disproportionate allocation of environmental problems to Latino, African-American and Native American communities. The movement has been highly influential in redirecting the environmental debate in the US, which no longer only focuses on the efficient and sustainable use of natural resources and the cult of wilderness and conservation of nature (Martinez-Alier 2002, 169). In 1991, the movement adopted a list of 'Principles of Environmental Justice'.

The environmental justice movement has its roots in the civil rights movement; from which it has adopted a frame and a language – emphasizing values such as individual rights, equal opportunities, social justice, human dignity and self-determination – which allow it to articulate concerns and demands (Ageyman et al 2003, 7). The movement has several important characteristics. First, it analyses environmental problems and conflicts in terms of power. "Who gets what, how much, when and why?" are some of the central questions of environmental justice. The concentration of power – financially, structurally, culturally – is at the root of choices from companies and governments. Second, the rights discourse is a central theme: the right to a clean and safe environment is explicitly defined as a human right, and furthermore a right which can be guaranteed through the recognition of civil rights such as the right to free speech, the right of association and the right of access to information. Third, the environmental justice movement is a grass roots movement, informally structured, organised bottom-up, with a crucial role for women and social networks. Fourth, the environmental justice movement is locally rooted, and treats environmental problems from "real people in real places" (Blowers 2003, 71).

An important question is whether the lessons learned in the US and the strategies followed, can be instructive for cases of environmental (in)justice elsewhere. According to Martinez-Alier, the greatest achievement of the movement is that by emphasizing racism, environmental justice emphasizes incommensurability of values, i.e. pollution cannot simply be compensated for by money when it is also a question of human dignity. At the same time he stresses that "the environmental justice movement is potentially of great importance, provided it learns to speak not only for the minorities inside the USA but also for the majorities outside the USA (which locally are not always defined racially) and provided it gets involved in issues such as biopiracy and biosafety, or climate change, beyond local instances of pollution. The civil rights heritage of the environmental justice movement of the USA is also useful worldwide because of its contributions to non-violent Gandhian forms of struggle." (Martinez-Alier 2002, 14). Martinez-Alier uses the broader term *environmentalism of the poor* or *ecologismo popular* to refer to a growing, new current of environmentalism, which grows out of ecological distribution conflicts and which refers to, amongst others, peasant and indigenous groups who defend their livelihoods. Martinez-Alier thinks this current will grow, since industrialised countries become more and more dependent on the South for raw materials, thus advancing the frontiers of exploitation of oil, gas, aluminium,

copper, eucalyptus and palm oil, shrimps, gold, transgenic soybeans into new territories (ibid., 11).

Ageyman et al (2003, 332) stress that different contexts and worldviews will generate different interpretations of, and approaches to, environmental justice. The base line is that people all over the world see their basic rights compromised by environmental devastation. In this view, the right to a clean and safe environment is an essential human right that should not be denied on the basis of race, class, ethnicity or position in the global economic system (ibid., 10). The environmental degradation and exploitation of the world's resources by industrialised countries is then illegitimate and a violation of human rights, since it undermines the life chances and life quality of people elsewhere.

Building on an article of Duncan McLaren ('Environmental Space, Equity and the Ecological Debt'), Ageyman et al (2003, 325-326) argue that the concepts of sustainability and justice are linked through the concepts of environmental space and environmental debt. In sustainable development and environmental space, the weight is primarily on inter-generational equity. In environmental justice and ecological debt, the weight is on intra-generational equity. Environmental space and ecological debt "provide a robust analytical framework through which to study the essential *reactivity* of the environmental justice project, and the *proactivity* of the sustainable development project" (ibid.).

1.5.4. Historical injustices and restitution

Within the context of debt and the question of how it should be dealt with, it might be instructive to look at some real cases of historical injustices that have been subject of so-called restitution. Joan Martinez-Alier (ibid., 228) refers to this point when he comments on the objection that debts are recognised obligations arising form contracts and, thus, a non-recognised debt such as the ecological debt, does not exist. He argues that 'there are cases in which debts have arisen without a contract' and refers to the obligation for Germany to pay reparations after the war and the German payment of some sort of indemnities for infringements to human rights (in this case, with the agreement of most citizens of the country)

Also John Dillon (Dillon John, 2001) touches this aspect, albeit in a negative way, where he refers to the UN Conference on Racism held in Durban where 'Northern governments fought tenaciously against any language in official declaration that implies an obligation on their part to pay reparations'.

Restitution, in the broad sense, has to be understood as a mosaic of different levels of acknowledging (historical) guilt. According to Elzar Barkan three different levels of acknowledgement can be distinguished (Barkan Elazar, 2000):

- Restitution (in the strict sense), i.e. the return of the actual belongings that were confiscated, seized, stolen,…
- Reparations, i.e. some form of material recompense for that which cannot be returned, such as human life, cultural identity, …
- Apology, i.e. no actual transfer (yet) takes place; however it is an admission of wrongdoing, recognition of its effects and – in some cases – an acceptance of responsibility

Keeping in mind the notion of ecological debt, we may already conclude that restitution in the strict sense is out of question as most of the resources taken from the South – at unequal terms of trade – were meant for consumption in the North. Neither can the North give back the environmental space it illegitimately used from the South, although it might free up environmental space in the future. The questions of reparation and apology are certainly at stake.

Analysing a few of the most recent restitution cases, Barkan concludes that apologies are (only) the first step. At the very minimum, apologies and a recognition of historical and ongoing injustices lead to a reformulated historical understanding and it creates new rights within an unequal world. Moreover it provides a space to negotiate agreements. It is therefore no surprise that all campaigns on ecological debt demand at least the recognition of ecological debt.

Another point which has been raised in the debate on restitution, is about the fundamental question of the incommensurability of values. Barkan states that a strong case for restitution is the fact that it would underscore a moral economy that 'calculates' and 'quantifies' evil and places a price on amending injustices. Such a theory of justice would obviously suffer from all the shortcomings of utilitarianism that have been exposed over the last two hundred years. The same critique has been expressed towards the claim for the actual collection of an ecological debt. Can you put a price on nature? However, one could argue, as Barkan does, that a demand for a fair compensation, which can be negotiated, is not the same as putting a price on it.

A thorough investigation of this last 'building block' might deliver other new insights and leads towards ecological debt and especially the way in which, once it has been defined properly and quantified, it can be used to leverage discussion and appeal for a joint effort towards global sustainability. In part 2, the growing state practice to provide restitution for some historical injustices will be discussed from a legal point of view as a possibility for introducing ecological debt in international law (see 2.3.1).

1.6. Conclusions for the core research

The goal of the core research was to clarify the concept of ecological debt in general terms: origin, definition, methodology, frame of reference.

The concept was originally coined by South American NGO's in the beginning of the nineties and first reached the international scene during the NGO discussions on Alternative Treaties at the UNCED Conference in Rio, 1992. Since 1997, in particular Southern but increasingly also Northern NGO's and NGO networks have been doing awareness raising on the concept and have been campaigning for the recognition of ecological debt. A few scientific articles have been published on the concept (although the term as such is not always used).

A review of the literature on ecological debt (from NGO sources and available scientific literature) and discussions with NGO's participating in the campaigns taught that the concept is still in a developing phase. There seems to be a general understanding of what ecological debt is, but there is no univocal definition: definitions differ between texts and actors, definitions change over time, terms are different interpreted. Furthermore, there is no agreed upon methodology to calculate ecological debt, either in physical or in monetary terms.

Calculations are always limited in time; they go back (e.g. for carbon debt) to at most 15 years, and often just one year is calculated. Another proof that the concept is still developing, is the fact that the discussion on what should be done politically with ecological debt is very limited. Two prominent demands are 'compensation' for accumulated ecological debt from the past and 'avoiding new accumulations' in the future through restructuring of production and consumption patterns in industrialised countries. Political interpretations of the concept usually refer to the external debt context or to climate negotiations (the carbon debt). Unanswered questions remain, such as how the concept can be introduced at different political levels, who should initiate it and how it should be interpreted in different contexts.

Amongst the factors contributing to the limited development of the concept, are: the fact that the development happens bottom-up through NGO campaigning, with different definitions and interpretations being used and new applications appearing; the fact that most of these NGOs have only limited means to campaign, to do some research and to lobby; the fact that direct scientific literature on the concept is almost non-existing; the fact that the link between campaigning and scientific work is weak. In this sense, the concept differs from popular concepts such as ecological footprints or environmental space, which were first developed by scientists and then enthusiastically taken up by the NGO community (which in turn stimulated further development).

The report argues that the weaknesses mentioned are rather on the level of operationalisation of the concept than on the level of the concept as such. The reality to which it refers cannot be denied: the historical and current ecological damage in other countries or to global ecosystems caused by industrialised countries and the over-use of ecosystem goods and services by industrialised countries are amply documented. The concept of ecological debt seems to draw together comparable experiences from (local) groups in the South and to unite them under the new label 'ecological debt'. This makes it easier to articulate the common concerns visible in protest against e.g. shrimp farming, mining, oil and gas exploitation or the overuse of the absorption capacity of the atmosphere. Besides, with its stress on historical responsibility, ecological debt adds a meaningful new dimension to the sustainability debate, which until now tends to be exclusively forward-looking. Furthermore, the linkage between external and ecological debt brings a new political perspective to international relations, i.e. a reversal of the creditor-debtor relation, with the North now in a debtor position and the South as creditor.

All these characteristics of the concept (bringing a historical perspective to the sustainability debate; bringing a new perspective on debtors-creditors to international politics; uniting comparable experiences of Southern peoples) can be seen as an example of 'cognitive praxis': through the use of the concept of ecological debt, social movements (from the South) are opening up a new context for interpretation – and in fact re-interpretation – of knowledge. The new perspectives, the new frame for looking at the world, open up a possibility – and when recognized a need – for rethinking of policies at different levels. These different characteristics of the concept turn ecological debt into a potentially powerful concept, but at the same time, due to the 'operational' weaknesses mentioned above, the usefulness of ecological debt in international policy and negotiations seems at the moment rather limited.

The research has shown that it should be possible to remedy some of these weaknesses. Through an analysis of the problem of defining concepts, a working definition was formulated for the ecological debt of countries, or what is sometimes called 'public ecological debt'. Following the working definition, the two main elements of ecological debt are 'causing ecological damage elsewhere' and 'using ecosystem goods and services at the expense of

equitable rights of others'. The proposed working definition allows for several refinements, e.g. refinements for what is meant by ecological damage, spatial scales of damage, equitable rights to ecosystem goods and services, debtors and creditors, time scales. Based on the working definition, definitions for other actors than countries can possibly be formulated.

The two main elements of the working definition ('ecological damage', 'use at the expense of equitable rights') lay the foundation for a methodology for calculating ecological debt in physical or monetary terms. The aspect 'ecological damage' can be measured by a combination of different indicators, which if desired can be organised through a DPSIR-framework. The aspect 'use at the expense of' can be measured by ecological footprints or environmental space, which need not necessarily be interpreted as a per capita measure for equity. In general, the research favours the environmental space approach. A necessary underlying tool for calculating a lot of aspects of damage or use is material flow analysis, since the methodology has to be able to trace ecological damage or use elsewhere. Information needed from MFA includes material requirement, the composition of this material requirement, the country of origin of the flows and their evolution over time.

All these instruments calculate ecological debt in physical terms. A next step can be a monetary valuation of this 'physical' ecological debt, for which purpose several techniques from neoclassical environmental economics are available. In the current debate on ecological debt, monetary valuations are dominant. The research project evaluates physical and monetary calculations as complementary. Monetary valuation is sometimes necessary (e.g. in the debate on external debt) and easily draws attention, but it is no absolute necessity since recognition of ecological debt or policy conclusions can also be drawn from physical quantifications, such as emissions of CO_2 or figures on land use abroad and coupled pollution (e.g. through fertiliser and pesticide use).

Apart from working on definitions and methodology, another important step for strengthening the concept of ecological debt is through further development of what has been called 'building blocks' of the concept. Several building blocks have been identified. 'Biophysical accounting systems' such as environmental space, ecological footprint and material flow analysis are necessary for defining the limitedness of the carrying capacity of the earth and how it should be dealt with in an equitable way. 'Ecological economics' seems to be an appropriate framework for analysing ecological debt from an economics point of view (e.g. the impact of trade). 'Environmental justice' and human rights provide an analysis of power and a language of rights which can become a tool for bringing ecological debt to the international forum. Theories and state practices on 'historical injustices' and restitution can provide information and experiences about restitution of past injustices and the role of recognition in this context.

References

Acción Ecológica (1999), 'No more plunder, they owe us the ecological debt!', http://www.deudaecologica.org/

Acción Ecológica (2000), 'Trade, climate change and the ecological debt', http://www.deudaecologica.org/

Ageyman, J., Bullard, R.D., Evans, B. (2003), *Just Sustainabilities. Development in an Unequal World*, Earthscan, London, pp. 347

Andersson, J. O., Lindroth, M. (2001), 'Ecologically unsustainable trade', in *Ecological Economics* 37, (2001), 113-122

Ashton, J., Wang, X. (2003), *Equity and Climate: In Principle and Practice*, Working Draft, Pew Center on Global Climate Change

Azar, C., Holmberg, J., (1995), 'Defining the generational environmental debt', in *Ecological Economics* 14 (1995), 7-19.

Barkan, E. (2000), *The Guilt of Nations. Restitution and Negotiating Historical Injustices*, Johns Hopkins University Press, Baltimore and London, pp. 414

Blowers Andrew (2003), 'Inequality and Community and the Challenge to Modernization: Evidence from the Nuclear Oases', in Ageyman Julian, Bullard Robert D., Evans Bob (2003), *Just Sustainabilities. Development in an Unequal World*, Earthscan, London, pp. 347

Bravo, E., Yánez I. (ed.)(2003), *No more looting and destruction! We the Peoples of the South are Ecological Creditors*, SPEDCA

Christian Aid (1999), *Who Owes Who? Climate Change, Debt, Equity and Survival*, http://www.deudaecologica.org/

Climate Action Network (2002), *Preventing Dangerous Climate Change*, Position Paper on the Adequacy of Commitments, released at COP-8 (New Delhi, India)

Climate Action Network (2003), *A Viable Global Framework for Preventing dangerous Climate Change*, CAN Discussion Paper for COP-9 (Milan, Italy)

Colectivo de Difusión de la Deuda Ecológica (2002), *Deuda Ecológica. El Norte está en deuda con los países del Sur*, http://www.deudaecologica.org/

Common, M. (2003), 'Monetary Valuation', in *Internet Encyclopaedia of Ecological Economics*, International Society for Ecological Economics, http://www.ecoeco.org/publica/encyc_entries/Mntryval.pdf

Copi, I.M., Cohen C. (2001), *Introduction to Logic*, 11th edition, Prentice Hall

Cörvers, R.J.M., Slot, W.F. (1998), 'Milieukunde en milieuproblemen', in *Basiscursus Milieukunde, analyse en oplossing van milieuproblemen. Cursusdeel 1*, vierde herziene versie (1998), Open Universiteit, Heerlen, p. 17-44

Costanza, R., Cumberland J., Daly H., Goodland R., Norgaard R. (1997), *An Introduction to Ecological Economics*, St. Lucie Press, Florida

Costanza, R., d'Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, A., O'Neill, R.V., Raskin, R.G., Sutton, P., van den Belt, M. (1997), 'The value of the world's ecosystem services and natural capital', in *Nature*, vol. 387, 15 May 1997

De Boer T.W. (1999), *Kritisch denken*, Uitgeverij Nieuwezijds, Amsterdam

Deblonde M. (2001), *Economics as a Political Muse. Philosophical Reflections on the Relevance of Economics for Ecological Policy*, Kluwer Academic Publishers

De Jonge, W., Mazijn, B., Van Assche, J. (2000), 'Milieugebruiksruimte: operationalisering van een vaag concept', in Mazijn B. (2000), *Duurzame ontwikkeling meervoudig bekeken*, Academia Press, Gent, pp. 1-67.

De Jonge, W., Van Assche, J, Mazijn, B. (2001), *Onderzoek naar de mogelijkheden en beperkingen van het concept milieugebruiksruimte. Eindrapport 2001*, onderzoek in opdracht van DWTC, CDO-RUG, Gent.

Dillon, J. (2001), *The History of the Ecological Debt Movement*, paper for the Conference 'Globalisation, Ecological Debt, Climate Change and Sustainability', Republic of Benin, November 27-30, 2001

Dömling Martina (ed.) (2002), *Sustainability and Justice: a Political North-South Dialogue*, World Summit Papers of the Heinrich Böll Foundation, No. 13

Donoso Aurora (2001a), *Ecological Debt: the Desecration of Life*, paper for the Sacred Earth, Sacred Community Theological Forum on Jubilee, Ecology and Aboriginal Peoples, May 11-12, 2001, Toronto, Canada

Donoso Aurora (2002), 'An Alliance to Stop the Destruction of Southern Peoples Livelihoods and Sustainability', speech delivered at the Indonesian Peoples' Forum, May 24th to June 5th 2002, Bali, Indonesia

Ecumenical Coalition for Economic Justice (2000), *Ecological Debt: South Tells North 'Time to Pay Up'*, http://www.deudaecologica.org/

Fisher-Kowalski M. (1998), Society's Metabolism. In Redclift, G., Woodgate, G. (Eds.) *International Handbook of Environmental Sociology*. Edward Elgar, Cheltenham.

Giljum Stefan (2003), *Biophysical dimensions of North-South trade: material flows and land use. Dissertation zur Erlangung des akadelischen Grades Doktor der Naturwissenschaften an der formal-naturwissenschaftlichen Fakultät der Universität Wien*, Wenen

Giljum S., Muradian R. (forthcoming), 'Global material flows and environmental distribution between North and South: a review of the empirical evidence' in Bunker, S.G., Martinez-Alier, J. (Eds.) *World system history and global environmental change*, Columbia University Press, New York.

Global Forum (1992), *NGO Alternative Treaties*, Rio de Janeiro, june 1-15, 1992 http://habitat.igc.org/treaties/index.htm

Haberl, H., Erb, K.H, Krausmann, F. (2001) 'How to calculate and interpret ecological footprints for long periods of time: the case of Austria 1926 – 1995', in *Ecological Economics* 38, 25-45.

IPCC (1999), IPCC First Assessment Report, http://www.ipcc.ch/pub/reports.htm

IPCC (2001a), *Climate Change 2001: Working Group II: Impacts, Adaptation and Vulnerability*

IPCC (2001b), *Climate Change 2001: Working Group III: Mitigation*

Jenkins (1996), 'Democratising the global economy by ecologicalising economics: the example of global warming' in *Ecological Economics* 16 (1996), 227-238.

Lecocq, F. (2004), *State and Trends of the Carbon Market 2004*, World Bank, Washington D.C.

Markandya Anil, Perelet Renat, Mason Pamela, Taylor Tim (2002), *Dictionary of Environmental Economics*, Earthscan, London

Martinez-Alier Joan (2002), *The Environmentalism of the Poor: A Study of Ecological Conflicts and Valuation*, Edward Elgar Pub

Martinez-Alier Joan, Simms Andrew, Rijnhout Leida (2003) 'Poverty, Development and Ecological Debt', leaflet

McLaren Duncan (2003), 'Environmental Space, Equity and the Ecological Debt', in Ageyman Julian, Bullard Robert D., Evans Bob (2003), *Just Sustainabilities. Development in an Unequal World*, Earthscan, London, pp. 19-37.

Miller, G.T. (1995), *Environmental Science. Working with the Earth* (5th edition), Wadsworth Publishing Company, Belmont, California

MIRA-T (2001 & 2002), 'Gebruik van Grondstoffen' in Report of the Flemish Environmental Council (MIRA-T)

Muradian Roldan, Martinez-Alier Joan (2001), 'Trade and the Environment: from a 'Southern' perspective', in *Ecological Economics* 36 (2001), 281-297

Muradian Roldan, O'Connor Martin, Martinez-Alier Joan (2002), 'Embodied pollution in trade: estimating the 'environmental load displacement' of industrialised countries' in *Ecological Economics* 41 (2002), 51-67

Opschoor H. (1995), 'Krapte aan milieugebruiksruimte', in *Oefeningen in duurzaamheid: perspectieven naar 2040*, Uitgeverij Jan Van Arkel, Utrecht, pp. 12-22.

Ott, H.E., Sachs, W. (2000), *Ethical Aspects of Emissions Trading*, Wuppertal Papers Nr. 110

Rees W., Wackernagel M. (1992), 'Ecological Footprints and Appropriated Carrying Capacity: Measuring the Natural Capital Requirements of the human Economy'. Second Meeting of the International Society for Ecological Economics, Stockholm.

Pearce, D., Barbier, E.B. (2000), *Blueprint for a Sustainable Economy*, Earthscan Publications Ltd, London

Robleto, M.L., Marcelo, W. (1992), *Deuda ecológica*, Instituto de Ecologia Politica, Santiago, Chile

Rochol Martin (2001), 'From environmental Space to Ecological Debt – A European Perspective', speech delivered at the Conference 'Globalisation, Ecological Debt, Climate Change and Sustainability', Republic of Benin, November 27-30, 2001, 8 pp.

Russi, D. (2003), 'Environmental liabilities: ecological damages quantification and responsibility', in Bravo, E., Yánez I. (ed.)(2003), *No more looting and destruction! We the Peoples of the South are Ecological Creditors*, SPEDCA

Sachs Wolfgang (2002), 'Closing remarks' in Dömling Martine (ed.) (2002), *Sustainability and Justice: A Political North-South Dialogue*, World Summit Papers of the Heinrich Böll Foundation, No. 13

Sachs Wolfgang (2003), *Environment and Human Rights*, Wuppertal Papers No. 137, November 2003, Wuppertal Institute for Climate, Environment, Energy

Shah Reena (2000), *International Frameworks of Environmental Statistics and Indicators*, paper for the 'Inception Workshop on the Institutional Strenghtening and Collection of Environment Statistics, 25-28 April 2000, Samarkand, Uzbekistan

Shaw Robert (s.d.), *The Use of Stipulative Definitions in the Development of New Zealand's Science Policy*, http://robertshaw.freeyellow.com/stipulative.html

Simms Andrew (2001), *An Environmental War Economy. The lessons of ecological debt and global warming*, New Economics Foundation, London

Simms A., Greenhill R. (2002), *Balancing the Other Budget. Proposals for Solving the Greater Debt Crisis. How Globalisation Creates Debt and why the Rich are in Debt to the Poor*, New Economics Foundation, London, 13 pp.

Smith, K. R. (1991), 'Allocating responsibility for global warming: the natural debt index', in *Ambio* 20(2), 95-96.

Smith, K.R. (1996), 'The Natural Debt: North and South', in Giambellucu, T.W., Henderson-Sellers A. (1996), *Climate Change: Developing Southern Hemisphere Perspectives*, John Wiley & Sons, Chicester/New York

Spangenberg, J.H., (ed.)(1995a), *Towards Sustainable Europe. A Study from the Wuppertal Institute for Friends of the Earth Europe*, Luton/Brussels, FoE Publications Ltd.

Spangenberg J.H. (ed.) (1995b), *Towards Sustainable Europe. A Friends of the Earth Europe Campaign. The Handbook.*

Torras, M., (2003), 'An Ecological Footprint Approach to External Debt Relief', in *World Development* Vol. 31, No. 12, pp. 2161-2171

Van der Heyden, H.A. (1998), 'Milieuproblemen als maatschappelijk verschijnsel', in *Basiscursus Milieukunde, analyse en oplossing van milieuproblemen. Cursusdeel 2*, vierde herziene versie (1998), Open Universiteit, Heerlen, p 11-35

Van der Heijden, H.A. (2000), *Tussen aanpassing en verzet. Milieubeweging en milieudiscours*, AMBO/Verkoopmaatschappij Bosch&Keuning, Antwerpen

VODO (2002), *Duurzame ontwikkeling door afbouw van de Ecologische Schuld. Memorandum n.a.v. de wereldtop Duurzame Ontwikkeling in Johannesburg (Zuid-Afrika) 2002*, Brussel

VODO (2002), *Final Report of the International Conference Sustainable Development and Globalisation. Rio+10: Is Europe Willing to Listen to the South?*, conference in Antwerp, 19-21 november 2001

Wackernagel Matthias, William Rees (1996), *Our Ecological Footprint. Reducing Human Impact on the Earth*, New Society Publishers, Gabriola Island, BC and Philadelphia, PA, 160 pp.