JOURNAL FÜR ENTWICKLUNGSPOLITIK
herausgegeben vom Mattersburger Kreis für Entwicklungspolitik
an den österreichischen Universitäten

vol. XXVI 4–2010

THE 'NATURE' OF DEVELOPMENT STUDIES
An Ecological Perspective on Uneven Development

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mandelbaum *edition südwind*

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Journal für Entwicklungspolitik XXVI 4-2010, S. 89-110

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A Toe in America, a Heel in Asia? A Discussion of the Applicability of the Ecological Footprint to International Trade

1. Introduction

Development studies have long been preoccupied with the question of uneven development between the global North and South, the core and periphery, or industrialised and developing nations. As a means by which uneven development is created and reproduced, international trade has received much attention. Not as the sole driver of development, but as an important factor in the structural relations between regions, trade has been analysed within world systems theory. In contrast to the dominant paradigm in development studies of the late 1960s and building strongly on the work of those who were later grouped together as dependency theorists (most notably Prebisch 1950; Singer 1950), this school of thought argued that a linear procession from an 'undeveloped' to a 'developed' state would and could not occur universally because of the role which countries or regions play within the world system. These roles are mediated by trade, which enables regions to act as sources of raw materials or labour for other regions. Literature on the structural analysis of the world system and on the role of trade in uneven development abounds (Frank 1966; Wallerstein 1974, 1980, 1989; Emmanuel 1972; Mandel 1975; Amin 1976). Next to the Marxist interpretation of wage differentials as the major factor leading to unequal exchange, the notion of ecologically unequal exchange has been introduced and applied (Martinez-Alier/O'Connor 1996; Bunker/Ciccantell 1999; Giljum/Eisenmenger 2004). Here, the emphasis is on types of exchange which can be measured in biophysical units, such as trade in materials, energy, land and time. While the economic and social value of this exchange is highly variable and more than one valuation may exist simultaneously, their biophysical nature is less strongly contested. An acre of fertile land is of very different value – economically and socially – to a subsistence farmer than to a mining company, yet in terms of its biophysicality, it is an acre of land to both parties. Thus focussing on biophysical units leads to the omission of important information about the transfer that is actually being made, but at the same time, this focus allows for the quantification of net transfers of resources or capital accumulation, which are fundamental to development (Bunker 1985; Martinez-Alier 1987; Hornborg 2001). The lenses through which world systems theory and the concept of unequal exchange examine development create a landscape of focussed and blurry areas, even omitting important elements from the picture altogether. That the focus will be sharpest on a macro-scale is an advantage in analysing patterns of international trade, yet this will have to be combined with analyses at other levels of scale in order to move towards a fuller understanding of the dynamics of development and their relation to environmental factors.

One of the currently most prominent representations of societal pressures on the environment is the ecological footprint (EF) – it is cited by media, governmental and NGO campaigns alike as well as in different scientific communities when it comes to illustrating sustainability issues. Could the application of this concept to international trade then increase the awareness of and the depth of the analysis of ecological distribution conflicts? This paper outlines the ecological footprint approach and methodology in order to specifically examine its potential for quantifying ecological burden-shifting associated with trade and resulting ecological distribution conflicts. Trade as such could theoretically provide environmental benefits (e.g. by allowing for production where the associated environmental burden is smallest). However, with the laws of the capitalist market and not sustainability measures governing it, foreign trade principally leads to a draw on natural resources and interference in the regenerative capacities of ecosystems that extend far beyond the borders of the importing country or region. Next to the structural and/or systemic evidence which can be cited, a method for quantifying the redistribution of ecological burden which occurs through trade is needed. The ecological footprint proposes to translate human societies' demand for natural resources into a bioproductive area requirement expressed in global hectares. Bioproductive area refers to that area of land and water on which significant photosynthetic activity occurs. The area required can be compared to the locally or globally available bioproductive area in order to verify whether or not a given society is consuming natural resources within or beyond local or global limits. In communicating the draw of countries on biocapacity outside their borders through trade, the ecological footprint analysis is a powerful tool. At the same time, it does not permit straightforward conclusions to be made regarding the sustainability of these trade relations.

2. Pushing the limits

"If we continue with business as usual, by the early 2030s we will need two planets to keep up with humanity's demand for goods and services" (Hails et al. 2008: 3)

In light of the persistent lack of a second earth, this forecast in the introduction to the 2008 Living Planet Report (LPR) of what awaits us if we don't 'change course' is a gloomy one. Published every two years by the World Wildlife Fund, the LPR assesses the state of planet Earth. While the Living Planet Index as a measure of biodiversity is used to analyse the condition of the earth's ecosystems, the ecological footprint is the tool of choice in approximating 'humanity's demand' on the earth's resources.

Humanity – in the words of the LPR – or more specifically human societies are dependent on the earth's resources to meet their metabolic needs. Much as the human body requires food, water, air, and light and produces wastes and emissions in the process of using these resources (basic metabolism), human societies require inputs (e.g. biomass, water, minerals, fossil energy carriers) and generate outputs (wastes and emissions). This societal metabolism (Ayres/Kneese 1968; Adriaanse et al. 1997; Fischer-Kowalski et al. 1997; Matthews et al. 2000) exceeds the sum of the basic metabolism of the members of each society: infrastructure and production of goods and services add substantially to the total throughput. In determining a given society's impact on the environment, both the composition and the volume of its metabolism play a decisive role. A cross-country comparison shows that societal metabolism is highly variable, depending especially on the principal mode of subsistence and the economic structure of the country, with geographic location and resource endowment playing a vital role. In meeting resource demands, trade has an increasingly important function. In most industrialised countries, fossil fuel and metal ore in the form of raw materials and secondary products are imported to a large extent rather than extracted or produced domestically (Krausmann et al. 2008).

In the Living Planet Report, 'humanity's demand' on the earth's resources is differentiated by countries, which are presented in terms of their role as ecological 'debtor' and 'creditor' countries: In very general terms, debtor countries are those which consume more resources than are available within their borders while creditor countries are those which consume less than is available on their territory.

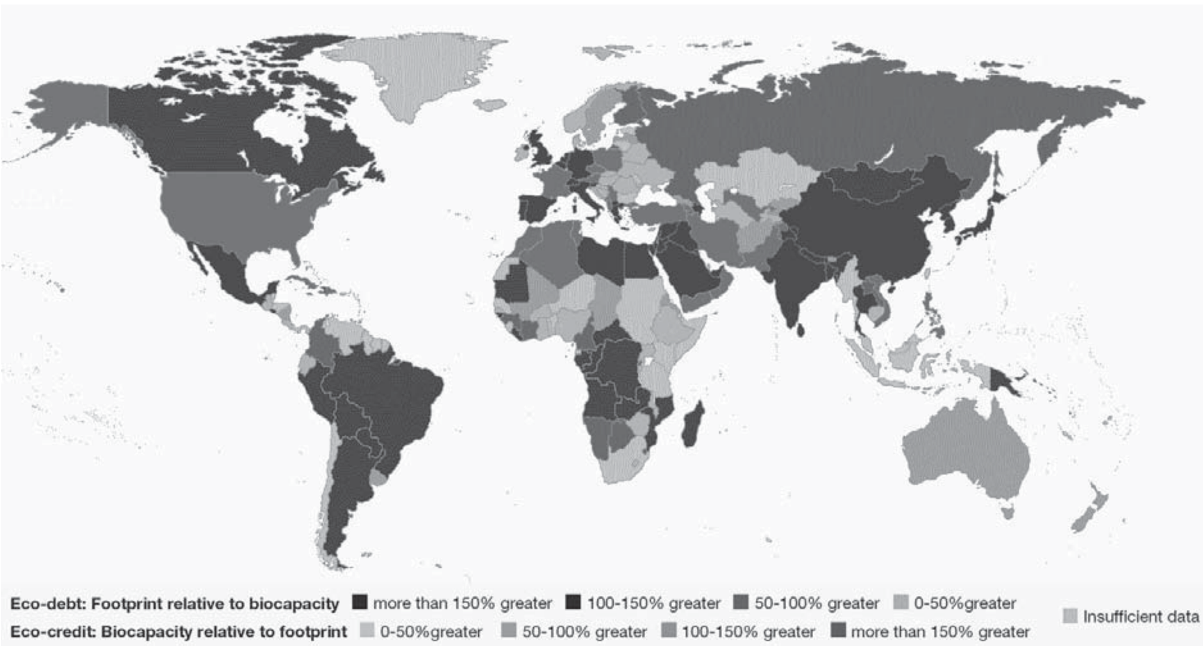

Figure 1: Ecological Debtors and Creditors of the World 2005
Source: adapted from Hails et al. 2008

In the framework of ecological footprint analysis, these results are obtained by comparing a country's ecological footprint to the bioproductive area, or biocapacity, available within that country. Resource use expressed as ecological footprint greatly exceeds available biocapacity in Spain and Italy or Libya and Egypt, for example. Other ecological debtors are Mexico and the USA, France and Germany, Morocco and Algeria or India and China. The ecological footprint lies significantly below biocapacity in much of South America, in Canada and parts of Middle and Southern Africa. Yet are these results already a good proxy measure for sustainability? How useful are they in assessing the role of trade? Does the shifting of environmental impacts through outsourcing production become visible using this approach?

In the following, a brief outline of the ecological footprint methodology will precede a more specific examination of how trade can be accounted for in EF analysis. The point of this assessment is to gauge the utility of the ecological footprint as a tool for quantifying ecological distribution conflicts.

3. What's in a footprint?

The ecological footprint is a very prominent and at the same time also highly contested indicator. The following section of the paper will be devoted to introducing the concept of the ecological footprint as it has been developed until now. The ecological footprint concept was developed in the early 1990s and originally introduced as *appropriated carrying capacity* (Rees 1992). The term *carrying capacity* was borrowed from the ecological discipline, where it is used to describe how many individuals of a given species can be permanently 'carried' or sustained by an ecosystem without causing irreparable damage to the functions and the productivity of that ecosystem (Odum 1983). Appropriated carrying capacity is then used to describe that part of this carrying capacity which is already claimed by human societies (Rees 1992). In the late 1990s, it was basically this concept that Wackernagel and Rees (1996) presented in more popular terms as ecological footprint analysis, "an accounting tool that enables us to estimate the resource consumption and waste assimilation requirements of a defined human population or economy in terms of a corresponding productive land area" (ibid.: 9).

The questions that ecological footprint analysis proposes to answer are: How much bioproductive land is required in order to sustain a given level of consumption - that is for the production of required resources as well as for the absorption of waste and emissions (Rees 2003)? How does this area compare to the *available* bioproductive area (Wackernagel et al. 2002)? This corresponds to the comparison of "human demands [...] with nature's available supply for human use" (Wackernagel et al. 1999: 317).

In the calculation of the ecological footprint, societal metabolism is translated into area units. This conversion can be quite intuitive for biomass-based raw materials and products (i.e. primary plant and animal biomass as well as secondary products such as non-synthetic textiles, wooden furniture, paper) on which the EF focuses: It reflects the (hypothetical) area required to grow them. Non-renewable materials such as fossil energy carriers, minerals and ores on the other hand, are included in the ecological footprint in terms of the built-up area as well as the energy requirements associated with extraction and production.

The ecological footprint is calculated for *apparent consumption*, i.e. for domestic extraction plus imports minus exports. This should allow for allocation of the ecological footprint to those socioeconomic systems generating the demand, i.e. where the final consumption occurs. The EF corresponding to the production of exported goods is accounted for within the total ecological footprint of the socioeconomic systems importing these goods. It is important to note that, in contrast to the monetary national accounts, the ecological footprint more or less follows a territorial principle. Its frame of reference is the apparent consumption within the territorial boundary of a system and not the apparent consumption generated by the residents of the system at hand (residence principle). This can best be illustrated using tourism as an example: By applying a territorial principle, the resources consumed by tourists are allocated to their travel destinations, i.e. to those countries in the borders of which the consumption occurs. Under the residence principle, this consumption of resources would be allocated to those countries of which the tourists are residents. International bunkering of fuel is another example in which it makes a difference whether a territorial or a residence principle is applied.

The ecological footprint distinguishes 5 land use categories which were developed by Wackernagel and Rees on the basis of the classification scheme of the International Union for the Conservation of Nature IUCN (Munro 1991): cropland, grazing land, forest, fishing grounds, and built-up land. These categories continue to be the ones commonly used in footprint studies (cf. Monfreda et al. 2004; Ewing et al. 2008). In most existing accounts, energy consumption is translated into forest area, sometimes denoted as carbon uptake land. The EF of energy use is usually calculated as the forest area which would be required to absorb the CO_2 emissions associated with the primary energy use of one year. The calculation is performed assuming an average global absorption rate for the forest (i.e. the measure of how many tons of carbon are absorbed by the forest per hectare and year) (Wackernagel 1999a; Monfreda et al. 2004; Kitzes et al. 2009). Carbon uptake land differs substantially from other land use types in the ecological footprint in that it has no real 'counterpart': While wheat is indeed harvested from crop land and livestock does feed off grazing land, it is not current practice to plant or preserve enough forest to offset greenhouse gas emissions. For most industrialised countries, carbon uptake land makes up the largest share in their ecological footprint. Aside from built-up land, the data for which comes from actual land cover statistics, all other categories in the ecological footprint must be understood as the translation of material flows into the hypothetical land area required to sustain them.

The unit of this hypothetical land area is the global hectare (gha), which allows for the comparability of EFs across nations and with the global footprint. This unit conversion is necessary because one hectare is simply not the same as the next in terms of biological productivity: One hectare of Austrian forest, for example, has an annual productivity of 6.16 m^3 harvested wood. The corresponding value for neighbouring Hungary is only about half as high at 2.90 m^3/ha (Global Footprint Network 2006). Direct comparison of the area required in Austria or Hungary to produce one cubic meter of wood would not be very enlightening in terms of the associated environmental impacts. Additionally, the productivity differs between the land types. The yield of one hectare of cropland is generally higher than the yield of one hectare of grazing land (cf. Haberl et al. 2007).

$$\text{Ecological Footprint [gha]} = \frac{\text{apparent consumption [t]}}{\text{global yield [t/ha]}} \times \text{equivalence factor [gha/ha]}$$

Figure 2: Basic Relations between Apparent Consumption, Global Yield, and the Equivalence Factor in EF Calculation

Equivalence factors are an expression of the relationship between the global average productivity of each land type and the global average productivity of all land types. Cropland, for instance, has the equivalence factor 2.14 gha/cap (cf. Ewing et al. 2008), meaning that the global average productivity of cropland is 2.14 times as high as the global average productivity of all land types.

Weighting the ecological footprint with the help of equivalence factors means that the ecological footprint does not depict actual land use but that the area must be understood symbolically as the common unit of equivalents of biological productivity (van den Bergh/Verbruggen 1999a, Haberl et al. 2001; Erb 2004). A global hectare is thus a unit describing one hectare of fictional land with globally average productivity.

4. Overshooting biocapacity and the role of trade

It is in comparison with biocapacity that the ecological footprint unfolds its meaning. As mentioned before, the concept of carrying capacity strongly influenced the development of this indicator, suggesting that, just as an ecological system can only 'carry' a certain number of individuals of a species without being damaged permanently, there is only limited biocapacity available to meet human demands for bioproductive areas (Wackernagel/Rees 1996). If the ecological footprint lies above biocapacity, the difference between the two is called ecological deficit or overshoot (in the context of human societies' demand on ecosystems, this term was especially coined by Meadows et al. (1972) and Catton (1980)). The commonly suggested interpretation of overshoot is that the regenerative capacity of ecosystems is overused (Wackernagel et al. 2002) as is the case when more CO_2 is emitted than can be absorbed in the available carbon sinks. The consequence is the accumulation of CO_2 in the atmosphere. According to the Global Footprint Network, the global footprint was 18 billion gha in 2007, corresponding to approximately 2.7 gha/cap. In the same year, the globally available biocapacity was just 11.9 billion gha (or 1.8 gha/cap) (Ewing et al. 2010). The ecological footprint was thus more than 50% higher than the biocapacity. This is often interpreted as though the biosphere would require 1.5 years in order to compensate the annual draw on the regenerative capacities of its ecosystems due to human consumption or as though 1.5 'earths' were needed to meet our resource demand without permanently damaging the ecosystems' regenerative capacity.

Globally speaking, the occurrence of overshoot can be thought of as corresponding to interference with ecological regenerative capacity. On any level of scale below the global, however, overshoot can result from appropriation of geographically remote biocapacity via trade. If, however, the ecological footprint lies below biocapacity that alone is not an indication of there being no strain on the regenerative capacity of ecosystems (Wackernagel 1999b; Haberl et al. 2001). This may be due to the fact that the entire resource consumption is not included in the calculation of the ecological footprint and that, as an estimate of the human demand for resources, it is thus based on a conservative estimate.

Conceptually, the ecological footprint is based on various assumptions by which different forms of resource use exercised by human societies can be translated into a common unit, namely that of area demand and supply. The idea behind this type of aggregation is to reduce complexity in the depiction of society-environment interaction, thus facilitating communication about this subject matter. The broad popular response by which the ecological footprint was met during the last decade is a reflection of this strength of the ecological footprint as a tool of communication (cf. van den Bergh/Verbruggen 1999b).

Whether or not the so-called overshoot immediately implies a lack of sustainability is dependent on the level of scale at which the ecological footprint and the available biocapacity are being compared. At the global level, linking sustainability to an ecological footprint which does not exceed biocapacity seems most plausible. Here, the EF is an expression of the biophysical limits of the global system. That human activity is interfering with the regenerative capacity of ecosystems is hardly contested at this level of aggregation (Costanza 2000; Luck et al. 2001; Nijkamp et al. 2004). In using the ecological footprint to analyze trade relations and the concurring shifting of environmental burdens, the global level is not so much of interest as is that of individual states, regions or cities. But what does it really mean if overshoot occurs on any of these subglobal levels? How can we imagine one of the WWF's 'ecological debtor' or 'creditor' countries? "[H]ow dependent is our study population on resource imports from 'elsewhere' […]?" (Wackernagel/Rees 1996: 9).

For one thing, what is true for the country as a whole is not necessarily true for its parts. This divergence is illustrated by the case of New Zealand, which is one of the countries for which studies of the ecological footprint exist both on a national (Bicknell et al. 1998) and a subnational level (McDonald/Patterson 2004). In the year 1997/98, New Zealand's ecological footprint amounted to approximately 65% of its available biocapacity, on the national average. The urban areas of Auckland, Wellington, and Nelson, however, were all in overshoot. As is usually the case with cities, their ecological footprint was well above locally available biocapacity. At the same time – due to the relatively high population density – the per capita EF was well below the national average in all three regions (McDonald/Patterson 2004). In this case, the national average ecological footprint offers very limited possibilities for assessing the state of ecosystems within the country. A country might exhibit an ecological footprint which lies well below its biocapacity at the national level. This could, however, also result from some areas with strong overshoot being 'balanced' in the national average by other areas well within the bounds of their biocapacity (cf. Senbel et al. 2003; Fiala 2008). Locally, the ecological conditions might still be deteriorating, with all the (potential) consequences for the local population entailed.

Cities are prominent among those areas in ecological overshoot. This is an expression of their characteristic dependence on their *hinterland* (Folke et al. 1997; Luck et al. 2001). In their initial presentation of the ecological footprint, Wackernagel and Rees (1996) used the city as an illustration. The inhabitants of the urban space would not be able to survive if the city were placed under a glass cover, severing its ties to the rest of the world both in terms of inputs (water, air, resources) and the possibility of discarding unwanted outputs (emissions, waste). Life in such a city would probably be pleasant for a very limited amount of time and then quickly become impossible. But rather than pursuing the question of whether the self-sufficiency of a designated area would technically be possible, it seems important to examine whether or not this self-sufficiency would imply sustainability and should therefore be aspired to.

5. Tracing the footprint of trade

It is precisely this question of the role of self-sufficiency in the ecological footprint that brings us to the question of how trade can be assessed in this framework. It is an often-voiced critique of the ecological footprint that it has a negative bias against trade (e.g. van den Bergh/Verbruggen 1999b) and that if a state, a city or a region can only be sustainable if its ecological footprint lies within the bounds of its biocapacity, that would be tantamount to a plea for self-sufficiency in attaining sustainability (Ayres 2000). That the ecological footprint is calculated for apparent consumption means that a country's ecological footprint lies below its biocapacity if the balance of its domestic extraction and imports on the one hand and its exports on the other hand lies below its biocapacity. Self-sufficiency is not a prerequisite. On the global level, the ecological footprint clearly helps to illustrate that not all countries can simultaneously be net-importers of bioproductive area.

Trade in itself is not necessarily a problem in terms of sustainability. Theoretically, one densely populated country or (urbanized) region might exhibit an ecological footprint that lies above the local biocapacity but rely mainly on imports from a sparsely populated region consuming less than it has available within its borders (Rees 1992). Whether this is the case or not has to do not only with a country's population density but of course also with its geographical location and resource endowment leading to varying conditions of production from country to country (Nijkamp et al. 2004). The economical benefits to be gained were illustrated by David Ricardo with the concept of comparative advantage (Ricardo 1817) and are now part of the standard repertoire of neoclassical economics. Setting aside the fact that production in the present day economic system is not determined by a quest to reduce environmental impact, a form of ecologically sustainable trade (and the corresponding international division of labour) might be conceivable in which production of goods occurs wherever this is possible with the least possible damage to ecosystems (Costanza et al. 1995; van den Bergh/Verbruggen 1999a). This impact would become visible within the ecological footprint through increasing world yield leading to a reduction of the world average EF (cf. figure 2): If produced under ideal soil and climatic conditions, the yield for the respective product can be expected to rise, leading to a higher world average yield (Andersson/Lindroth 2001). In spite of much enthusiasm for the potential benefits to be gained from international trade for human well-being on the whole (e.g. Ayres 2000), the realisation of this potential is quite obviously not just around the corner in the currently given system of world trade which is neither ecologically sustainable nor socially just (Martinez-Alier 1987; Costanza 2000; Hornborg 2001; Hornborg et al. 2007). The ecological footprint of the economies of industrialised countries tends to feature 'a toe dug into Latin America and a heel ground into Asia', in metaphorical terms, which are doing anything but relieving the economic and social pressure in these regions.

What the ecological footprint can thus be used to illustrate is the dependency of a country or a region on the 'import of bioproductive area' rather than an *a priori* sustainability problem. Using the ecological footprint to analyse trade relations can point in the direction of where and to what extent the consumption within one country or region could potentially cause sustainability problems beyond its borders (cf. Erb 2002): Trade can lead to overusing biocapacity in the exporting countries. The ecological footprint further offers a tool for the illustration of how densely populated areas are dependent on importing contested resources and how consequentially the security of their supply is in no way guaranteed (Wackernagel/Rees 1996; Folke et al. 1997; Vuuren/Bouwman 2005).

International trade leads to environmental burdens and damages which frequently occur in other places than the corresponding consumption of goods and services. In order to be able not only to cite the structural and/or systemic evidence for this circumstance, it would be helpful to have an indicator with which to map the spatial disparities between final resource consumption and related environmental impacts. With an approach similar to the scheme of debtor and creditor countries proposed in the Living Planet Report, it is mainly conceptual work that has been done in terms of exploring the potential use of the ecological footprint in the analysis of trade relations (e.g. Andersson/Lindroth 2001; Wackernagel/Giljum 2001). By calculating the ecological footprint separately for domestic extraction, imports and exports, how much of a country's biocapacity is 'exported' can be assessed. Next to the distinction between ecological surplus and deficit, countries can be identified as net importers or exporters of EF (Andersson/Lindroth 2001). Due to the somewhat ambiguous depiction of sustainability in the ecological footprint framework, how straightforward the conclusion that Andersson and Lindroth suggest (ibid.: 116) as to whether the 'ecological capital' of countries is increasing or decreasing is contested.

While the ecological footprint is clearly a powerful tool in illustrating disparities in trade relations – the idea that a country takes up more 'space' through its physical trade balance than is available within its borders is quite an accessible one – much of the methodological work in finding approaches to analyse ecological burden-shifting through trade is moving in another direction. In order to be able not only to account for the direct material imports and exports, as the material flow accounting (MFA) framework currently makes it possible to do, but to further take into consideration the intermediate inputs that were required in the production of exported goods, it is necessary to open the black box of the economy with which MFA currently still operates. Next to LCA-based approaches for individual goods, the most common approach in economy-wide assessments has been the use of input-output data in order to trace the inputs into the production process (e.g. Hubacek/Giljum 2003).

6. Conclusion – are distribution conflicts leaving footprints?

Foreign trade leads to a draw on natural resources and an interference with the regenerative capacities of ecosystems that extends far beyond the borders of the importing country or region. It creates a rift between environmental impacts and the final consumption with which they are ultimately associated. At the same time, it is a stark illustration of the rift between the possibilities for political intervention, by national governments or international organizations, into economic decision-making and the dimensions of the environmental impacts that are associated with trade and the production of traded goods (cf. Fischer-Kowalski/Erb 2003).

Within the competition for ecological space which Wackernagel suggests can be illustrated with the help of the ecological footprint, the competition for bioproductive area figures prominently. Whether it is large-scale industrial agriculture or small-scale subsistence farming, human lives are dependent on the production and often also on the trade of biomass products. Issues pertaining to access to land are dominant in many environmental conflicts. Agricultural products have steadily become more important in terms of international trade: Between 1961 and 2007, the total volume of traded agricultural products increased by a factor of almost 6 from 178 million to over a billion tonnes per year (FAOSTAT 2010). In the EU27, for which physical trade data is available from Eurostat (2010), biomass made up 25% of all exports and 18% of all imports in 2007. At the same time, agricultural products play an important role in international stock markets with traded futures in various crops increasing steadily. Especially in terms of mapping ecologically unequal exchange, the EF is a rather intuitively accessible tool. The imagery of the area into which biomass flows, energy use, and land use-related activities are translated is quite powerful in making the claim on exporting countries visible. Using the available EF data, it would be possible to 'map the world' in terms of countries dependent on 'imported biocapacity' and to thus contribute to the analysis of power relations manifest in control over ecological resources in general and bioproductive land in particular.

Yet not all sustainability issues can be depicted using the ecological footprint. Along with what has already been discussed in this paper with regard to the ambiguity of the relationship between the ecological footprint and biocapacity, there are important forms of resource use and environmental burden that are simply not reflected in the ecological footprint. The EF is a snapshot of current resource use with an almost exclusive focus on biomass – it cannot take into account many forms of environmental pollution (McDonald/Patterson 2004), although some attempts have been made to calculate the area that would be needed for the absorption of pollutants (e.g. Folke et al. 1997on nitrogen and phosphate). The EF further cannot distinguish between more or less sustainable forms of land use. Often, intensification of agriculture will lead to a reduction of the ecological footprint because of the entailed increase in yields (van den Bergh/Verbruggen 1999a; Lewan/Simmons 2001). Due to the degradation of agricultural land that this form of production potentially causes and the effects on the regenerative capacities of ecosystems, larger ecological footprints could turn out to be more sustainable in the long run than smaller ones (Fiala 2008; Kitzes et al. 2009). This, however, lies beyond the field of vision in the EF snapshot; the eventual decrease in yield due to overuse of resources in agriculture cannot be depicted (cf. Vuuren/Bouwman 2005). The extraction and use of non-biomass resources is only marginally considered in the EF framework: The area occupied by e.g. mining sites for minerals is included as built-up land, the energy used in extraction and production processes is translated into carbon uptake land. And, just as is the case for fossil fuels, the limited availability and non-renewable character of minerals cannot be taken into account in the EF (Wackernagel/Rees 1996; Senbel et al. 2003).

Furthermore, while the ecological footprint and biocapacity may allow for conclusions about sustainability to be made at a global level (Ayres 2000), the threshold which would allow for a clear distinction between a sustainable and an unsustainable EF is lacking for sub-systems.

As strongly as the ecological footprint helps visualise potential environmental problems, it leaves the field of potential solutions hazy. Implications for political decision makers are not very straightforward (van den Bergh/Verbruggen 1999b). Alternatively, they turn out to be inapplicable in their generalisation. With a certain amount of exaggeration but nonetheless with some truth, it has been pointed out that the comparison between ecological footprint and biocapacity in principle only allows for one of three conclusions: If the ecological footprint lies below biocapacity, use more land. If there is overshoot, reduce consumption or population (Moffatt 2000; for an analysis of the correlation between ecological footprint and population see York et al. 2003).

On the one hand, the ecological footprint is continuously subject to methodological renovation and may eventually overcome some of the problems it currently faces. On the other hand, the need to better understand the shifting of environmental burdens through international trade is spurring the development of new tools to help us in quantifying these processes, such as the raw material equivalents (RME) of trade within the MFA framework (cf. Weinzettel/Kovanda 2009) and the exploration of embodied human appropriation of net primary production eHANPP (cf. Erb et al. 2009; Haberl et al. 2009). Notwithstanding, the ecological footprint has been essential in creating public awareness for the impossibility of unlimited growth in a physically limited world. It has helped to illustrate how high levels of consumption of natural resources within geographical regions and economic segments of society encroach upon the abilities of others to meet even their most basic resource needs.

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Abstracts

As a means by which uneven development is created and reproduced, international trade has received much attention. Foreign trade leads to a draw on natural resources and an interference with regenerative capacities of ecosystems that extend far beyond the borders of the importing country or region. Next to the structural and/or systemic evidence which can be cited, a method for the quantification of the redistribution of ecological burden which occurs through international trade is needed. The ecological footprint (EF) proposes to translate human societies' demand for natural resources into a bioproductive area requirement expressed in global hectares. The latter figure can be compared to the locally or globally available bioproductive area, in order to verify whether or not a given society is consuming natural resources within or beyond local or global limits. In communicating the draw of countries on biocapacity outside their borders through trade, ecological footprint analysis is a powerful tool. At the same time, it does not permit straightforward conclusions as to the sustainability of these trade relations. This paper outlines the ecological footprint methodology and, more specifically, examines how trade is accounted for in EF analysis in order to gauge the utility of the ecological footprint as a tool for quantifying ecological distribution conflicts.

In der Entwicklungstheorie ist der Rolle des internationalen Außenhandels (insbesondere im Zusammenhang mit ungleicher Entwicklung) bereits viel Aufmerksamkeit geschenkt worden. Mit diesen Außenhandelsflüssen gehen Beanspruchungen natürlicher Ressourcen und Eingriffe in die Regenerationsfähigkeit von Ökosystemen einher, die weit über die Grenzen des importierenden Landes hinausreichen – dafür liegen strukturelle bzw. systemische Belege vor. Doch wird darüber hinaus eine Methode zur Quantifizierung der Umverteilung von Umweltbelastungen durch internationalen Handel benötigt. Der ökologische Fußabdruck übersetzt die gesellschaftliche Nachfrage nach natürlichen Ressourcen in eine (hypothetisch) damit einhergehende Nachfrage nach bioproduktiver Fläche, die in der Einheit des „globalen Hektars" bemessen wird. Aus dem Vergleich des ökologischen Fußabdrucks mit der vorhandenen bioproduktiven Fläche soll ersichtlich werden, ob der Ressourcenkonsum einer Gesellschaft gege-

bene ökologische Grenzen überschreitet oder nicht. Unter anderem weil er die Auslagerung von Umweltauswirkungen durch internationalen Handel bildhaft veranschaulicht, ist der ökologische Fußabdruck als Kommunikationsmittel ein wirkungsvolles Instrument. Jedoch erlaubt er keine direkten Rückschlüsse auf die Nachhaltigkeit der jeweiligen Handelsbeziehungen. Im vorliegenden Artikel wird die Methode des ökologischen Fußabdrucks umrissen, das spezielle Augenmerk liegt hier darauf, wie der Außenhandel darin wiedergegeben wird, um die Nützlichkeit dieses Ansatzes in der Quantifizierung von ökologischen Verteilungskonflikten zu bewerten.

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