

Draft Correspondence – (submitted to *Journal of Industrial Ecology*)

Letters to the editor commenting on articles published in the *Journal of Industrial Ecology*]

Response to “Footprint Policy? Land Use as an Environmental Indicator”

Van den Bergh and Grazi (2013) offer an assessment of Ecological Footprint accounting’s policy relevance. This important subject merits critical examination. While their paper contains many intriguing ideas, their argument is not structured to address the question they have raised.

In order to determine whether Ecological Footprint accounting is policy relevant, at least four fundamental questions, addressed in a logical sequence, must be addressed first:

- 1. What underlying question does the Footprint address?** Without attending to the actual question Footprint accounting answers, criticism easily focuses on aspects that are unrelated to the actual question.
- 2. If the question the Footprint addresses is clear, is the question relevant to policy concerns?** If the underlying question is clear but not relevant to the identified problem area, then the tool is not useful.
- 3. If the question is relevant, are there more accurate methods available elsewhere for answering this particular question?** If so, then other tools should be used.
- 4. If no better methods are available, is society better off without the results this method generates?** It could well be that the answers would be so poor or misleading, that it would be better not to have any estimates at all.

Since the van den Bergh and Grazi paper addresses these fundamental questions inadequately, the assessment remains inconclusive, as explained below question by question.

- 1) What underlying question does the Footprint address?** The Footprint accounting attempts to answer the following question: how much do people demand from ecosystems compared to what those ecosystems (or the biosphere as a whole) can regenerate? Its purpose is to measure how big an economy’s metabolism is compared to nature’s ability to provide for this metabolism (Borucke et al. 2013). Van den Bergh and Grazi’s paper neither mentions the intent behind nor the actual question driving Footprint accounting. Rather, van den Bergh and Grazi imply claims and objectives that Footprint accounting does not advance as indicated in earlier responses to articles by van

den Bergh and his colleagues (e.g., Wackernagel and Silverstein 2000).

For instance, nowhere do Footprint accounts measure hypothetical hectares. They are real areas. Real demand is compared to real supply. More specifically, Footprint accounts measures how many of these real areas are needed to provide a given flow of resources and ecological services. If demand exceeds supply, a multiple of an actual, real area is needed to provide this flow. Consider the example: “This orchard only provides half the apples this population consumes.” This orchard is not hypothetical, just too small for the demand. Similarly, if timber in a forest in a given year was harvested 50 percent more rapidly than timber re-grew, it means that for that year demand corresponded to one-and-a-half fold the existing biocapacity of that forest (the difference comes from stock depletion). The same logic applies to the carbon Footprint: There, demand (carbon emissions expressed as demand for sequestration capacity) is compared to dedicated sequestration capacity (forest dedicated to sequestration).¹

The accounts show for the globe as a whole: current total forest capacity is smaller than the combined demand for forest products and carbon sequestration. .

Neither do Footprint accounts determine whether a population is sustainable. Rather, Footprint accounts provide relevant and necessary information to sustainability assessments and identify areas of non-sustainability. Footprint accounts attempt to measure how much biologically productive area, i.e., biocapacity, is needed to meet the competing demands on ecosystems, given prevailing technology (Borucke et al. 2013, Galli et al. 2007, Wackernagel et al. 2013). These biocapacity-adjusted areas for both Footprints and biocapacity are expressed in a common measurement unit called global hectares. They represent hectares with world average productivity (Galli et al. 2007). In other words, one global hectare represents an equal share of the biosphere’s regenerative capacity (About 12 billion hectares of the planet are biologically highly productive – hence one global hectare represents 1/12 billionth of the productivity of that surface. The other 39 billion hectares of the Earth’s surface are only marginally productive – deep oceans, ice fields, deserts – and are not included in the biocapacity accounts (Borucke et al. 2013)). This approach parallels financial statistics that convert local currencies into (nominal or constant) US dollars, farmers who adjust calculations of available land for its ability to support cattle (expressed as “cow-calf acres” or “animal units” in rangeland management), or various types of greenhouse gases that are converted into CO₂ equivalents for their equivalent warming potential. In Footprint accounts, the common denominator is units of biocapacity expressed in global hectares. These global hectares are not representing potential damage, but as mentioned above roughly 1/12 billionth of the total regeneration capacity of the biosphere. This capacity can be used to sequester CO₂

¹Note: Since Global Footprint Network does not have reliable global data documenting which exact portion of the forests are dedicated to long-term sequestration and which ones are available to harvesting, its accounts have one biocapacity category for forest serving two competing Footprint categories: forest product Footprint and carbon Footprint.

or to grow food or to produce fiber or for any other non-overlapping (competing) use of biocapacity.

- 2) **If the question the Footprint addresses is clear, is the question relevant to policy concerns?** The paper does not discuss whether the underlying question Footprint accounting pursues is relevant or not. If van den Bergh and Grazi believe it is irrelevant to know how much human activities demand as compared to what the biosphere can regenerate, they should explain why. Just as it is important for farmers to know the size of their farm, whether their farmland extends over 5,000, 500 or 5 hectares, having knowledge about the productive capacity of one's land makes a significant difference to the opportunities that are available to the farmer. The same logic applies to a region, a country, or the whole world.
- 3) **If the Footprint question is relevant, are there more accurate methods available elsewhere for answering its particular question?** Van den Bergh and Grazi's paper does not explain how to better measure human demand against the biosphere's supply, which is the main purpose of Footprint accounts. There are other measures, but Footprint accounts are unique in their ability to compare biocapacity supply and demand at various scales. For instance, Rockström and colleagues (2009) confirm global overshoot independently of Footprint calculations, however not in a way that allows researchers to compare the situation of each nation, or to put the various demands in context with each other. Smil (2012) presents a number of potential measures in a rich and information-packed book. One is the distribution of mammalian biomass. Smil claims in that book (and in other publications such as Smil 2003) that wild mammals make up less than 3% of mammalian biomass on land, while the remaining 97% are made up by people and domesticated animals. Given that humanity in addition to this dominance in biomass burns significant amounts of fossil fuel, leading to a massive carbon debt in the atmosphere and the oceans, the 97% figure points to a striking dominance of the human enterprise. But by how much? Does this 97% figure already indicate global overshoot? This is a question Footprint accounting answers.

Another measure Smil (2012) discusses is net primary productivity (NPP) assessment. He quotes one calculation which concludes that 17% of global NPP is used by the human enterprise. How does this relate to the 97% biomass figure above, and how close is this 17% figure from a figure for maximum NPP removal? This inconsistency stems both from the 17% number being within a large range of estimates, 10-50 percent according to Rojstaczer et al. (2001) as well as from the difficulty in comparing removal of NPP against a maximum sustainable harvest rate. What to include in the calculation of NPP production and particularly in NPP removal is open to interpretation (for instance, should the roots of the felled tree left in the ground be counted as removal or not? What about the ferns trampled by the forest workers?). In contrast, Footprint accounts, which are based on an agricultural approach, can more sharply determine this relationship. After all, it is both possible and current practice to compare cubic meters of timber removed with cubic meters of timber regenerated. Any forester can produce such estimates with reasonable accuracy, even using simple technology. Hence, Footprint accounts offer a more reliable and robust accounting framework for comparing human demand on

ecosystems against ecosystem regeneration than NPP assessments are able to provide. (Granted, sometimes such estimates get altered and misreported in official statistics due to economic or political interests – for instance, to hide illegal harvests or to show fulfilled quotas. But such distorted data is not a unique weakness of Footprint accounting, but affects all official statistics, including GDP or population numbers).

Others (including Eurostat 2010, see particularly Chapter 2: “Economy-wide material flows”) use material flow analysis such as total material requirement as an overarching metric for capturing the size of the human metabolism and track overall resource efficiency. Such an assessment counts each kilogram of mass movement as equal. Of course adding one kilogram of fossil fuel to one kilogram of gravel is possible. But it is significantly less meaningful than aggregating global hectares since each of the global hectares represents an equal share of the world’s biocapacity. As explained, competing demands for biocapacity can be expressed in global hectares, including the use of one kilogram of fossil fuel or one kilogram of gravel. Furthermore, aggregate indicators extracted from mass flow analysis such as total material requirement are questionable even when not compared to supply, because defining a “mass flow” is ambiguous and can be highly arbitrary. What exactly qualifies to be included and what not? For instance, how far does any kilogram of mass have to be moved in order to be counted? Should air and water be included as well? Is plowing soil moving kilograms of mass? Or stacking one rock on top of another one? Again, demand on ecosystem productivity as done in Footprint accounting offers a more robust assessment approach. Granted, Footprint and biocapacity results cannot be computed with ultimate accuracy either (and neither can GDP or greenhouse gas inventories). Footprint results may have inaccuracies going into double digit percentage points, but depending on how mass flows are defined, differences in results may be at least one order of magnitude.

Then there are the monetary measures of natural capital (e.g., World Bank 2011; UNEP, UNU-IHDP 2012). Financial accounts such as the ones referenced neither address the question underlying Footprint accounting nor compare demand against supply. In addition, Footprint accounts provide a relative assessment of various demands (i.e., how much of the demand on the biosphere comes from food, shelter, mobility, or vice versa, how much do forests, fishing grounds, or cropland contribute to the overall capacity of the biosphere). Also, looking at the various demands in parallel helps to answer the question: Is the resolution of one problem just shifting pressure onto another domain or is the net demand on nature decreasing? Obviously, Footprint accounts do not capture the entire “problematique” of human-nature interactions. But from a perspective on net demand on regenerative capacity, Footprint accounts bring competing demands on biocapacity into one overall equation, rather than splitting issues related to fishing, grazing, forestry, cropland, urbanization, climate change, energy and water into silos.

- 4) If there are no better methods to answer the Footprint question, is society better off without the results this method generates?** Maybe, even if Footprint critics are satisfied with answers to the three questions above, they may still be concerned that Footprint results are excessively inaccurate. Therefore, Footprint results need to be tested

by end-users. If governments of countries believe that it does matter how much biocapacity they use compared to how much they have (i.e., they recognize the relevance of the issue being measured by Footprint accounts— see question 2), then it is ultimately up to their own scientific advisors to test whether the numbers generated are an adequate representation of their situation. So far over a dozen national government agencies have reviewed Global Footprint Network's National Footprint Accounts (2011) for their country. Some of the assessment reports are available on Global Footprint Network's website (www.footprintnetwork.org/reviews). For instance, the French statistical office of the Ministry of Sustainable Development independently recalculated the French Footprint from 1961 to today. Its results were within 1-3 percent of Global Footprint Network's assessments (SOeS 2010). So either van den Bergh and Grazi do not accept the relevance of the questions Footprint accounting addresses, or they do but fear that the results are so inaccurate that they would lead to cures worse than the disease. Their paper is not clear on where they stand.

In summary, the Grazi and van den Berg paper does not adequately answer these four questions which determine whether Ecological Footprint accounting is policy relevant, and repeats previous criticism about Footprint accounts without substantiation. In response to these claims we have explained elsewhere that Ecological Footprint accounts are neither anti-trade, nor anti-technology, nor limited to national assessments, nor providing a theory of value (see FAQs at www.footprintnetwork.org/faq, Wackernagel (1999); Wackernagel and Silverstein (2000), and Wackernagel et al. (forthcoming)). Footprint accounts point out trackable and economically challenging mismatches between human demand and ecological availability. If human demand on an ecosystem exceeds regeneration (i.e., if there is too high pressure on existing ecosystems), the ecological literature calls this “overshoot” (not “hypothetical land”, as termed by van den Berg and Grazi). Footprint accounts are accounts; pictures of what is, not what could be.

Even if van den Berg and Grazi found the question underlying the Footprint relevant, and the answers sufficiently accurate to be published, the question still remains: are Footprint accounts *policy* relevant? That should be investigated rigorously, but only once the Footprint method passes the test of the foundational four questions above, a task which Van den Berg and Grazi did not complete in their paper and without which their claims cannot be substantiated. But we should also consider the opposite: Could it be that many of our policies are not relevant to sustainability? Ultimately we have to determine: Is it a significant risk or not for a country to run ever larger biocapacity deficits in a world in overshoot? Will people who both earn less income than world average *and* run biocapacity deficits (i.e., about half of the current world population) be able to access sufficient biocapacity? And if not, what could this mean for their well-being?

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