A Preliminary Review of and some Responses to

Sustainable Consumption and Production – Development of an Evidence Base: Study of Ecological Footprinting (2005)

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Final Report, prepared for Department for Environment, Food & Rural Affairs (DEFRA) by Risk and Policy Analysts, Ltd.

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About Global Footprint Network

Global Footprint Network is a charitable social-benefit organization established in 2003 in California to make ecological limits central to decision-making everywhere. We do this by advancing the robustness and policy relevance of the Ecological Footprint. Together with our over 50 partner organizations around the world, we coordinate critical research, develop methodological standards (and eventually a certification system), all in service of providing decision makers with robust resource accounts to help the human economy operate within the Earth's ecological limits.

Main Findings

Context of Global Footprint Network

Global Footprint Network is dedicated to advancing the scientific rigor and practical application of the Ecological Footprint, a tool that quantifies human demand on nature, and nature's capacity to meet these demands. One of our key initiatives, together with our 50 partner organizations around the world, is the development of methodological standards to make results are comparable and use the best data sets. Therefore, Global Footprint Network strongly encourages any research which explores the robustness of the Ecological Footprint method.

Context of the Reviewed Study

Judging from the page count of Sustainable Consumption and Production – Development of an Evidence Base: Study of Ecological Footprinting prepared for Department for Environment, Food & Rural Affairs (Defra) and published in June of 2005, this report represents a significant research effort. In reviewing this study, however, we were disappointed by the quality of the report. For instance, it contains a number of factual errors and asserts conclusions without providing evidence to support them. Also, the main development, the fact that Global Footprint Network and its partner organizations are engaging in standardization, is barely covered by the report. We also do not have any records that any of our staff was ever contacted by the researchers of this report for input or comments.

The report primarily claims that Ecological Footprint analysis is not useful for policy making. The following is a summary of the arguments made in the report in support this conclusion. However, we find these arguments weak for a number of reasons:

- they claim that a certain normative characteristics inherent in Ecological Footprint analysis exists (e.g. it is "anti-trade," or "anti-technology") which is not the case;
- they misrepresent how the Footprint is calculated;
- they misinterpret the results;
- they misrepresent conclusions from other reports (particularly Ecotec/STOA report).

Lack of focus of the Footprint study

The report does not state against what criteria the Footprint is being judged. We suggest that the Footprint should be judged according to:

- what is the research question that the Footprint addresses,
- is this question relevant, and why,
- and, if it is relevant, what better tools than Ecological Footprint analysis exist to address this question?

The report commissioned from Risk and Policy Analysts, Ltd. (RPA) for Defra (hereafter referred to as "RPA report") fails to mention the underlying research question the Footprint is meant to get at, i.e. how much of the regenerative capacity of the biosphere is occupied by human activities? Nor does the report discuss whether what the Footprint addresses is a relevant research question, or whether any better approaches exist to address these issues.

As Ecological Footprint analysis practitioners, we believe that sustainability critically depends on our ability to measure global ecological overshoot – and we believe it is impossible to stay in permanent overshoot without causing ecosystem collapse. The Footprint is a conservative measure of the ecological overshoot of the human economy. Hence, the Footprint measures necessary, albeit insufficient, conditions for sustainability. Not having an accounting tool to measure global overshoot would be a significant liability. RPA report mentions no other, better way to track global overshoot.

Further, the RPA report never acknowledges this conception of Ecological Footprint analysis, which is recognized and accepted by the Footprint community. The Footprint was never intended to be the "one measure of everything." However, the report criticizes Ecological Footprint analysis on the grounds that it doesn't measure everything, and then concludes that it is not a useful instrument for advising policy. This is an explicit part of the emerging standards.

In fact, the report goes so far as to criticize the Footprint for not being an indicator of social sustainability (p. 38). Of course it was never designed to do this, and Footprint proponents do not claims that it can or should indicate social development.

Conclusions of commissioned report

The conclusion of the RPA report—that Ecological Footprint analysis is not useful for policy considerations—seems to have been settled before the report was written. It is noteworthy that a large majority of citations used to criticize Ecological Footprint analysis come from a few sources (van Kooten and Bulte 1999 and 2000, and IVM 2003), even though Ecological Footprint analysis has been utilized and discussed in at least 130 peer-reviewed scientific publications and hundreds or thousands more "populist" publications. Van Kooten and Bulte were cited 8 times over 11 pages in the section criticizing Ecological Footprint analysis methodology. IVM was cited 11 times over 30 pages on Ecological Footprint analysis criticism.

Given the abundance and variety of scholarly articles treating the Footprint, at a first pass, a reader of the RPA report may be surprised by the lack of diversity in sources that criticize the Footprint. Additionally, the RPA report cites van Kooten and Bulte as concluding that "the eco-footprint can be used alongside other measures of sustainability to provide an indication of direction, but [it] should not be relied upon as a sole measure or even a reliable measure of how societies might overshoot their carrying capacities." We believe that criticism needs to be as critically analyzed as the proposed calculation method itself – otherwise it is not an evidence based assessment of the validity of the tool.

Comparison to Ecotec Report

It is also noteworthy to look at how the RPA report treats other items from the review literature on Ecological Footprint analysis. The report *Ecological Footprinting* commissioned for the European Parliament and authored by Ecotec-UK (hereafter "Ecotec report") and cited frequently in the RPA report, presents, in our opinion, a better informed and more objective look at Ecological Footprint analysis theory and practice. We also would like to note that the Ecotec report is already 4 years old, and many enhancements and expansion of Ecological Footprint methodology and applications have occurred since its publication.

The Ecotec report is sited in the RPA report 11 times. In 8 of these 11 instances, the RPA report cites Ecotec in order to substantiate some criticism against Ecological Footprint analysis. (The remaining 3 instances consist of two technical clarifications and one complimentary assessment of Ecological Footprint analysis—that it "has fewer conceptual or practical problems than indicators such as Green GDP, the ISEW and Total Materials Requirement.") From this manner of citation, a reader of the RPA report might conclude that the Ecotec report was, in an overall sense, strongly unfavorable of Ecological Footprint analysis.

However, among the findings of the Ecotec report are that:

- "The objective of the Compound Approach is to utilise internationally standardised data to arrive at a robust *under*estimate of the EF." (Ecotec, page 18) Note that this contradicts the RPA report's repeated assertions that EFs are overestimated.
- "Because the focus is on the *nation as a whole* there is no need to identify which sectors, firms or sub-national regions make use of particular resources or emit pollutants. In this respect it is a

rather easy methodology to operationalise utilising whole economy data that is produced in a standardised format by the UN and other agencies such as the IPCC." (Ecotec, page 18) Note that this contradicts the RPA report's assertions that Ecological Footprint analysis is convoluted and too difficult to yield practical results.

- "Current practice overstates the supply of land so therefore understates *ecological overshoot.* This is consistent with EFs claim to be a conservative estimate of sustainability. Efforts are made for supply of fisheries and forest land to use an optimistic estimate of maximum sustainable yield rather than what might be an unsustainable actual yield per hectare." (Ecotec, page 28) Note again that this contradicts the RPA report's assertions that EFs are overestimated and thus politically implausible.
- "There are several strengths of EF which shall be mentioned in summary form (Ecotec, page 30):
    1. The unit of a measure *biologically productive land and sea standardised to the world average level* is easy to comprehend.
    2. EF has a credible and concrete upper bound constraint.
    3. Proponents of EF have gone to some effort to explain the limitations of EF especially in terms of coverage. As a result its assumptions and weaknesses are transparent.
    4. As a result EF is a powerful communications device with resonance over a wide variety of different audiences.
    5. EF is a flow concept that can be contrasted with other flows such as GDP and HDI.
    6. The data requirements for national EF calculations are reasonably easy to locate, make use of widely known official data and do not hinge on untenable assumptions (except for proviso in point 7).
    7. The 'strong sustainability' ethical position of EF, though controversially applied with CO2 absorption, does give a consistency of approach to handling different issues.
    8. Except for proviso in 7, we would support EF comparisons over time and per capita EFs across countries as being a credible estimate of major human impacts."

  Note that none of the above statements, with the exception of the proviso in point 7, support the conclusion of the RPA report—that Ecological Footprint analysis is unhelpful for policy decisions—and, in fact, seem to be a clear indication to the contrary. And, we at Global Footprint Network would argue that the Footprint does not adhere to any strict ethical positions about strong or weak sustainability as indicated in point 7 (more on this below).

And among the conclusions of the Ecotec report is that:

- "National EFs can be calculated for EU countries with good precision and transparency. We recommend they be calculated on an experimental basis for national and sub-national territories. Excluded environmental issues should be clearly indicated. Such an EF would make a credible Headline Indicator." (Ecotec, page 39)

That the Footprint has been recommended as a "credible Headline Indicator" to the European Parliament would presumably warrant prominent feature in a report intended to outline an "evidence base" for consideration of the Ecological Footprint as a policy-relevant sustainability indicator. But it seems that the RPA report has selectively cited the Ecotec report in a manner which systematically omitted evidence that may reflect favorably on the Footprint.

Conclusion

For this reason, we at Global Footprint Network feel that the authors of the RPA report have done a disservice to Defra and to the Footprint community by issuing a report that collates several common criticisms of Ecological Footprint analysis, but does not examine these criticisms in depth to test their validity. Again, we regret that in the process of researching and composing this report none of the

consultants contacted us for comments or assistance. If Ecological Footprint analysis practitioners and Global Footprint Network were brought into the process initially to help clear up misconceptions and common misrepresentations of Ecological Footprint analysis, a more balanced and accurate report could have been produced.

As it stands, the RPA report concludes that the Footprint is mainly useful as a communication and education tool, and for encouraging individual consumers to engage in more ecologically responsible personal consumption and lifestyle activities. This is only one function of Ecological Footprint analysis. Other, perhaps higher leverage roles for Ecological Footprint analysis in analyzing and transforming the human economy towards sustainability are downplayed, dismissed, or ignored in the RPA report. Global Footprint Network, representing over 50 organizations and government agencies currently using the Ecological Footprint, is more than willing to provide information and respond to queries that address some of the problematic areas in this report, and to provide scientific and technical support for future reports to Defra on Ecological Footprint analysis.

To initiate this process, we have highlighted below some general and specific issues from the RPA report for additional discussion, reconsideration and/or possible correction.

We have also included two appendices detailing our criticism of the RPA report, and are happy to discuss these with you for further clarification. Please note that this is not a complete assessment of the report, only some of the distortions or errors we found in our initial reading of the report.

Interest in a more in-depth review of national Footprint accounts

As mentioned earlier in a letter to Jill Rutter, we would welcome the opportunity to work with you in a more evidence based analysis of the Footprint method. We'd be particularly happy to have Defra engage in an audit of Ecological Footprint accounts for the UK – similar to the audits that are now underway in Switzerland, sponsored by four federal agencies.

Appendix 1: Responses to more general criticisms of the RPA report

Transparency
The report criticizes Ecological Footprint analysis on several accounts for lacking of transparency in the methods. The words "transparent" or "transparency" appear 14 times in the document. However, it is one of Global Footprint Network's primary aims to reduce this problem. Together with our partner organizations, we are working to standardize and make transparent Ecological Footprint methods. Any of our recent publications appropriately provide evidence of these efforts. The most up-to-date detailed methodology employed by the Global Footprint Network for calculating Footprints and Biocapacity can be downloaded for free at http://www.footprintnetwork.org/gfn_sub.php?content=download.

Standardization
The RPA report criticizes Ecological Footprint analysis for a lack of standardization in the methods. This criticism appears about 17 times in the document. However, it is one of Global Footprint Network's primary aims to reduce this problem (see above, and also http://www.footprintnetwork.org/gfn_sub.php?content=standards for information on our standards process).

On page 58 the RPA report does admit that "more recent reports generally provide more and better information than earlier studies," in reference to issues of transparency and standardization.

Individualism
The RPA report over-emphasizes the utility of Ecological Footprint analysis for promoting individual lifestyle changes, mentioning the concept at least 12 times. On pages 73-74, the RPA authors' state that, "the key messages given by eco-footprinting is that an individual's consumption has a significant impact and that measures should be taken to reduce it." This message is reiterated in the report over a dozen times. The report overemphasizes this message and downplays or fails to mention the power of Ecological Footprint analysis for transforming infrastructures and social, political and economic systems.

In fact, much of individuals' Footprint is out of direct individual control, but can only be addressed through collective decision making, macro-economic and legislative or regulatory action. For example, an individual may prefer to commute by public transit, but if no transit system is available or existing systems are undesirable, then they may commute by private car. This is not so much an individual choice as a collective one. This is one of the principal strengths of Ecological Footprint analysis; yet this aspect is largely ignored by the RPA report, which frames Ecological Footprint analysis as a communication tool for encouraging more ecologically responsible individual consumption decisions.

Over- versus under- estimates
The report states in at least 6 separate instances that biocapacity is underestimated, and mentions in several instances that Footprints are overestimated (or are at least too large to render the Footprint a "politically feasible" method). However, in Ecological Footprint analysis, Biocapacity is systematically *over*estimated and Footprints systematically *under*estimated, to insure the most conservative scenarios of natural capital liquidation are portrayed. How and why this is so is explained in more detail in the methodology paper linked above.

Disaggregation of Footprint
On page 75 and at other instances in the RPA report, the authors allege that Ecological Footprint analysis is not useful because it cannot be broken down into components or sectors, or disaggregated, etc. This is incorrect. It can be disaggregated into components and used in that manner.

Anomalous conclusions
The RPA report presents a lot of Ecological Footprint analysis results and tables of data culled from other sources, but only one dataset actually calculated by the authors (Table 5.2). This table shows "required reduction in resource use" for different regions of the UK. It is based on average Footprints and

biocapacities for these regions taken from several Ecological Footprint analysis studies, as compared with the 1.8 gha/capita available globally. The RPA authors' calculations indicate that "UK areas should be reducing the resource consumption by between 57% and 74%, and on average 68%."

We think this is an inappropriate use of Ecological Footprint data. Ecological Footprint analysis says nothing about what anyone *should* do. This number merely shows how much the UK Footprint would need to be reduced to be at 1.8 global hectares per person. Whether this is desirable or not is a decision for policymakers.

Aggregate measure not useful

The main conclusion of the RPA report is that "policy making requires consideration of a range of factors and therefore the aggregation of consumption data, which is the key feature of eco-footprinting, is not necessary." Using this logic, then GDP, Dow Jones, NASDAQ, the GINI coefficient, Human Development Index, and many other aggregate indicators are not useful for considering policy options. We doubt the authors would be willing to dispense with GDP or these others as indicators to inform policy decisions. It is not clear why a different standard is applied in judging the usefulness of the Ecological Footprint.

This also contradicts RPA report's conclusion that Ecological Footprint analysis "may provide the best available measure [of sustainability] at present." (page 46)

Appendix 2: Responses to specific issues in the RPA Report

Page i
Page i states that Ecological Footprint analysis converts resource consumption into "a single index—the land area needed to sustain a given population indefinitely," which is incorrect. Ecological Footprint analysis says nothing about sustaining a population for any amount of time in the future. This misconception is repeated throughout the RPA report (e.g. page ix, page 6).

Page ii
Page ii conflates the concepts of mutually exclusive land types with double-counting. This common misconception about Ecological Footprint analysis methodology is repeated throughout the RPA report. (See explication in methodology paper linked above.)

Page iii
Page iii claims that Ecological Footprint analysis is "black box" in nature. Global Footprint Network was organized primarily to provide transparency and a process of standardization for Ecological Footprint analysis. This misconception is repeated throughout the report (e.g. "black box" appears on page 31, twice on page 45, and on page 82). (See the methodology paper and standards process documents linked above. Also note that Academic licenses are available for free from Global Footprint Network)

Pages vi, 39, 40, 45, 46, 74
Page vi says that the Footprint is basically only valuable as a communication tool, i.e. that it is not useful as a rigorous scientific measure and is not useful for informing policy. This theme is repeated throughout the RPA report (e.g. page 39 where the Footprint characterized as "primarily an attention-grabbing device," and "a light-hearted device for self-analysis"); however, the report provides little evidence that Ecological Footprint analysis is neither a scientific approach nor policy relevant.

Also cited here (page vi) is a criticism based on "lack of standard methodology," which is an express aim of Global Footprint Network. Again on pages 39 and 40, the "lack of a standard methodology" and the fact that the methodology is developing, "make comparing eco-footprints over time or between areas more difficult," and "prevent [its] use as a performance indicator." Although, the RPA authors do admit (on page 39) that a time series of data for the UK "is available from 1961 to the present which has been back calculated based on the most recent methodology." This statement seems to contradict the authors' prior statement about the difficulty of comparing Footprints over time.

Page 45 states, "there is a level of uncertainty in the results of eco-footprinting, some of which is real and some of which is perceived, arising from necessary detail and variety of data used." It is not clear what is meant by this (real versus perceived) or what point the authors are making.

And page 46 states that "the continued development of the eco-footprinting methodology makes it difficult to use the eco-footprint as an indicator to demonstrate progress," while in the next paragraph asserting that "eco-footprinting on its own is not yet capable of identifying how far we are from sustainability with any certainty, although it may provide the best available measure at present."

It's not clear exactly how the RPA authors define "progress." This criticism is repeated on page 74 in that "one of the key properties of a communications tool is that it should be able to demonstrate progress over time (or lack of it). The effectiveness of component eco-footprints as a method of communicating progress is therefore limited at present…" Footprints just track human demand on the biosphere, and how it changes over time.

The RPA authors do state, however, that Ecological Footprint analysis may provide the "best available measure" for (un-)sustainability at present. Additionally, by way of comparison with other sustainability indicators, on page 66, the authors indicate that "eco-footprinting has fewer conceptual or practical

problems than indicators such as Green GDP, the ISEW and Total Material Requirement." These strike us as important findings that would likely merit a position of greater prominence in the report. Again on page 74, the authors indicate that despite being controversial, the use of energy land "may currently be the best method available." Thus, the authors apparently consider Ecological Footprint analysis the "best available" method on both overall and specific accounts; yet these determinations are not highlighted in the summary sections of the report, but rather are buried in the details.

It states on page vi that "aggregation of consumption data, which is the key feature of [Ecological Footprint analysis] is not necessary." For one, nothing says that the Footprint has to be aggregated. It can be disaggregated and used that way. Two, if aggregation of data is unhelpful to policy, then what of GDP, Dow Jones, NASDAQ, the GINI coefficient, Human Development Index, or any of a host of aggregate measures upon which policy decisions are currently being made?

Finally, on page vi the report states, "policy decisions will always need to take into account a wider range of environmental, social and economic factors." Of course this is true, but in itself does not constitute a criticism of Ecological Footprint analysis. Ecological Footprint analysis is not meant to be the consummate measure of everything, and has never been promoted as such.

Page ix

In the glossary on page ix, the concepts of ecological deficit and overshoot are conflated. This misconception is repeated throughout the report (e.g. box 2.2, page 8), and is incorrectly used to support the claims that Ecological Footprint analysis is inherently "anti-trade" (see below, and page 33 of the report).

According to published Ecological Footprint analysis methodology (see methodology paper linked above), "a Footprint greater than total Biocapacity indicates that demands exceed the regenerative capacity of existing natural capital. For example, the products from a forest harvested at twice its regeneration rate have a Footprint twice the size of the forest. We call the amount of overuse "ecological deficit". Ecological deficits are compensated in two ways: either the deficit is balanced through imports, resulting in "ecological trade deficit" or, as in this forest product example, the deficit is met through the overuse of domestic resources, leading to natural capital depletion ('ecological overshoot')."

Pages 5, 28, 37

On page 5, Ecological Footprint analysis is suggested to derive from a strict "strong sustainability" perspective, which the RPA report understands to mean a "[rejection of] the substitution of natural capital with man-made resources." One point is that "strong sustainability" does not mean *no* substitution of capital forms, it just means *limited* substitution—as opposed to the infinite substitutability of man-made for natural capital assumed in standard economic practice. Another point is that Ecological Footprint analysis doesn't comment on the possibility (or impossibility) or degree of substitution between forms of capital—it simply tracks the use natural capital resources at current management practices and the current level of technology.

Identifying Ecological Footprint analysis with strong sustainability occurs throughout the report, e.g. page 28. Here the RPA authors state that because Ecological Footprint analysis is based on strict strong sustainability (defined as rejecting all substitution of man-made and natural capital), "solutions to environmental problems that depend on substitution cannot be studied using eco-footprinting." This conclusion is not correct because Ecological Footprint analysis makes no assumptions about substitutability between man-made and natural capital.

The authors cite van Kooten and Bulte regarding notions about the "optimal" stock of natural capital—and allege that Ecological Footprint analysis is biased against liquidating natural capital, which is an undesirable bias because development may require some "disinvestment" in natural capital, and "there is no reason to assume that the current stock of natural capital is optimal." However, Ecological Footprint analysis says nothing about what level of natural capital should be considered optimal. Ecological Footprint analysis measures the demand and supply for (renewable) natural capital. It does not

preconceive an "optimal" allocation of assets between human and natural capital. It does not judge any proportion of capital types to be preferable to any other. It simply tracks demand and supply for ecosystem services. Of course, one can understandably recognize the dependence of human-made capital on natural capital, and hold whatever degree of skepticism of the interchangeability of these forms of capital, but Ecological Footprint analysis is independent of these ideas and sentiments.

On page 37 the authors reiterate the discussion of an "optimal" level of natural capital stocks, and criticize Ecological Footprint analysis for being impervious to this. They state that "while the eco-footprint relies on the assumption that the current stock of natural capital is somehow optimal, there is no reason why depleting some of it may not be optimal. In that case, one would advocate a (temporarily) larger eco-footprint."

For one, as indicated above, Ecological Footprint analysis does not assume an optimality or non-optimality of current conditions of natural capital. Two, depleting natural capital may indeed by un-optimal, if it is already exploited beyond a critical point and its regenerative ability is compromised. Ecological Footprint analysis addresses this *indirectly*, by showing decreasing trends in biocapacity as stocks are degraded—it doesn't in any case say whether this is "optimal" or not, just that it is happening. Three, by "temporarily larger eco-footprint," the authors really mean temporary *overshoot*, which may or may not be optimal or acceptable. Ecological Footprint analysis doesn't tell you if it's OK to be in overshoot—that the future will get better despite ecological degradation in the present—it just tells you *if you indeed are in* overshoot. Policy makers must decide the magnitude and type of threat(s) posed by overshoot and what policy options may be exercised to provide for "optimality," however defined. Ecological Footprint analysis just indicates overshoot—it doesn't tell you what to do about it.

Page 10

The RPA report indicates here that the authors are only considering the Footprint of consumption. This is not correct. One can also calculate the Footprint of primary production or embodied in trade flows.

Pages 14, 16, 22

In many places, there are simple errors of fact. For instance, on page 14, the LPR 2004 is said to cover "more than 250 nations." It should be 150.

Page 16 shows a graph from Global Footprint Network, but does not cite the specific publication or version shown. Pages 22 and 36 also omit citations for quoted data.

The portion of CO2 absorbed by oceans is quoted on page 22 as 31 – 35%, and on page 36 as 29 – 35%.

Page 19

Page 19, box 2.6 restates the main conclusion of the report—that Ecological Footprint analysis "results are not directly useable for policy purposes…"—in the form of an argument premise, as a disadvantage of the compound approach to Ecological Footprint analysis. Rhetorical logic suggests that an argument cannot both serve as a premise and its conclusion.

Page 21, 34-36, 74

Page 21 exposes a repeated misconception of energy land, namely that it is "hypothetical" in character. Sequestration land is real land – the area of forest required to incorporate excess atmospheric CO2 from fossil fuel burning. If there is not enough of it, this means overshoot – not hypothetical. In other parts of the report, this correct concept of energy land is acknowledged. Thus it is unclear why the authors term energy land to be "hypothetical." More of this problem appears on pages 34-36.

On page 34 the authors again cite van Kooten and Bulte concerning "the significance of the greenhouse effect and whether carbon emissions are really damaging to the environment." And on page 36 they cite IVM (again) saying that "although there is a general consensus that atmospheric concentrations of carbon dioxide must stabilize in the future, it is not clear whether the situation is critical at this time." Here the authors are questioning the validity of climate science, not Ecological Footprint analysis. Whether

human-induced climate change is critical at this time is not a matter of contention for Ecological Footprint analysis. The Footprint simply provides a carbon accounting system, and indicates the buildup of CO2 in the atmosphere—whether this buildup proves to be deleterious to ecosystems or human society is not within the purview of Footprint analysis.

On page 34, the RPA authors suggest that "our energy eco-footprint is not subject to area constraints," and on page 35 they call Ecological Footprint analysis's treatment of energy "asymmetrical…relative to its treatment of agriculture, forestry and urban land use." These assertions are misconceived. CO2 is a pollutant produced by fossil fuel burning. It accumulates in the atmosphere, which is a limited sink—as evidenced by the rise in CO2 concentration. So fossil fuel energy use is indeed subject to biocapacity constraints.

Despite their criticisms of energy land, the authors of the RPA report still consider that the use of energy land "may currently be the best method available." (page 74)

Page 30

On page 30, the RPA authors ascribe characteristics to Ecological Footprint analysis proponents that may or may not be warranted regarding types of waste and pollution not directly captured by Ecological Footprint analysis. They state, "the general view taken by eco-footprint proponents is that society should have zero tolerance for highly toxic wastes and radioactive substances for which the environment has no assimilative capacity. These substances should be banned, phased out, or handled in totally closed loops." Ecological Footprint analysis does treat the use of these substances only indirectly—through biocapacity measurements. If toxic substances are released into the environment with damage to biocapacity, future biocapacity estimates will capture that (as long as data is available).

Pages 31, 32, 38, 42

On page 31, the report criticizes Ecological Footprint analysis for being based upon incomplete, non-standard or uncertain data sets. Any measure of anything is subject to these criticisms, even established measures like GDP. Is Footprint data better or worse than data used to calculate GDP or other current economic or environmental indicators? The report does not say, just that Ecological Footprint analysis data is maybe not as good as it could be. Global Footprint Network uses UN statistics as primary input and does not control the quality of those data.

And on pages 31-32, the authors cite van Kooten and Bulte in questioning the assumption that "resource and waste flows are easy to measure and covert to 'productive' land area," and suggest that "little is known about what happens to wastes when they enter ecosystems (e.g. how they are broken down, how long they reside in ecosystems, potential damages they cause…" This in itself is not a criticism of Ecological Footprint analysis *per se*. It's just an admission that performing robust and accurate Ecological Footprint analysis is a difficult and time-consuming task.

Page 32

On page 32 there is a mischaracterization of the way Ecological Footprint analysis treats technological change. Implied there is that the Footprint doesn't account for technological change, which is not correct. If more the use of more efficient technology reduces resource consumption, all other things being equal, this will be reflected in a smaller Footprint. Ecological Footprint analysis also captures technology in biocapacity measurements, which vary according to the dominant technology being employed at the time. If "green" technologies come into play, this will be reflected in increased biocapacities/yields. Ecological Footprint analysis does not predict what the future will look like with green technologies in place, although future Footprint scenarios can be modeled given whatever assumptions about technology might be considered relevant. But Ecological Footprint analysis itself is just a snapshot of what *is*—how things are right now, under current management practices and current technologies. That Ecological Footprint analysis is inherently "anti-technology" is a common, yet unfounded, criticism of the method.

Pages 33, 37
Another criticism of Ecological Footprint analysis is that it "contains an intrinsic bias against trade." This claim stems from van Kooten and Bulte. The authors assert that this "ignores the environmental benefits of a concentration of the population (reduced habitat fragmentation, shorter transport lines and scale effects for waste processing, water and electricity supply)." This is incorrect.

The RPA report does note that "it is not possible for all countries to be net importers of ecological capacity." Ecological Footprint analysis is consistent with this conclusion. But this does not mean, as the report claims, that Ecological Footprint analysis implies that for a country to import ecological capacity is a bad thing, or that this constitutes an "anti-trade" bias intrinsic to Ecological Footprint analysis. Ecological Footprint analysis just shows the dependencies—it doesn't say whether they are good or bad—this is for policymakers to decide. This rationale suggests that Ecological Footprint analysis is in fact a useful tool to inform policy making. But that runs counter to the main conclusion of the RPA report –that the Footprint is unhelpful for policy making.

The anti-trade claim is repeated on page 37.

Pages 35-36
Pages 35 and 36 contain a multitude of fallacies regarding Ecological Footprint analysis and notions concerned with basic thermodynamic principles, and even some outright contradictions occurring within a few lines of text.

Page 36 criticizes Ecological Footprint analysis for not incorporating the potential for green (renewable, biomass-based) energy technologies. It states, "carbon dioxide emissions are likely to be a temporary problem, since technological progress spurs the development of alternative sources if energy. By substituting forest area needed to sequester carbon dioxide with the area of renewables needed to perform the same task, it is possible to include technological progress much more directly in the energy eco-footprint."

There are numerous problems here. One is that the Footprint does not incorporate the potential for green (non-fossil fuel based) energy technologies nor for any other technology; Ecological Footprint analysis is historical, rather than predictive. It measures what has been actually used, not what might be used at some future time.

Another problem is that the RPA report states that CO2 emissions "are likely to be a temporary problem." Whether CO2 emissions are a temporary or long-term problem is not a factor in Ecological Footprint analysis. To reiterate, the Footprint simply provides a carbon accounting system, and indicates the buildup of CO2 in the atmosphere—whether this buildup proves to be deleterious to ecosystems or human society is not within the purview of Footprint analysis.

The RPA report seems to suggest that Ecological Footprint analysis is at fault for not sufficiently appreciating how inventive humans are to come up with resource substitutes. This is not a legitimate criticism of the Footprint, since again, the Footprint is just a reflection of what *is*, and doesn't make any judgment about of the creativity of humans. The RPA report does acknowledge on page 36 that "the eco-footprint represents the current impact under the prevailing technology," but then still goes on to criticize Ecological Footprint analysis for not incorporating scenarios that do not yet, and might not ever, exist.

And finally, on pages 35-36 a claim is made that Ecological Footprint analysis insists that CO2 emitted in a country must be sequestered by biomass in that country; thus the biocapacity of a country fundamentally limits that country's capabilities for fossil fuel combustion. However, the Footprint makes no specification of where atmospheric CO2 should be absorbed, and while it can inform policymakers of the impacts of their decisions, never says what they should or should not do.