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Misplaced Critique: assumptions and applications of the EF

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In a paper recently published in this journal, Roth et al. (2000) critique the concept of ecological footprints (EF). We are surprised that this paper was accepted as it fails to acknowledge the extensive debate on the EF concept published in a special issue of the journal *Ecological Economics* in March 2000. As the paper by Roth et al. was accepted on July 27, the authors certainly had sufficient time to restructure their in many respects misplaced critique. However, it is not only their failure to acknowledge already published material that we find alarming. They present opinions and viewpoints as though they were new and their own. Our main opposition to their review is that they misrepresent and misinterpret our perspectives of the EF method and its usage.

van den Bergh and Verbruggen (1999), in a very detailed and healthy critique of the EF concept, have already presented almost all the general points of critique raised by Roth et al. This is only properly acknowledged once, and therefore gives the impression that the Roth et al. critique is original. This is misleading. Let us illustrate with some excerpts:

Roth et al. (p. 463) write: “There are aggregation problems associated with Wackernagel and Rees’ (1996) original methodology due to equal ecological weights being given to all land uses (i.e. 1 ha pasture is equal to 1 ha highway)”. No immediate reference is given to van den Bergh and Verbruggen who write (p. 64): “Worse even, some categories receive identical weight, even if it is clear that their environmental impact are very distinct. For

instance, in the EF procedure land used by infrastructure has the same weight as land use by agriculture." In the next sentence, Roth et al. state that "(EF) has a anti-trade bias…trade may very well provide a means of reducing the global 'ecological footprint'." Only a general reference to this is given at the end of the paragraph: "(for further discussion please see van den Bergh and Verbruggen 1999)". The reader is given the impression that these are Roth et al.'s own conclusions. Van den Bergh and Verbruggen clearly elaborate on the trade issue in their paper (p. 67): "A fifth objection against the EF is that it has an anti-trade bias…trade can in principle spatially distribute the environmental burden among the least sensitive natural systems." Additionally, Roth et al state (with no reference given) (p. 463): "It has been realised that the use of the analogy of an "ecological footprint" as an index is a static measurement mostly used at country level…and is not based on relevant border criteria for ecosystems (i.e. watersheds)." This is also discussed extensively in van den Bergh and Verbruggen (pp. 66) e.g. "A fourth objection relates to the arbitrariness of the spatial scales at which EF is calculated."

While some of the critique put forward by Roth et al. is of a general nature, most is focused on the use of EF for analysis of aquaculture production. We have published several of the aquaculture papers the critique refers to. We are highly supportive of innovative and thoughtful discussions and critique, as these can result in creative extensions into new areas. Roth et al.'s paper is a failure in these respects.

Roth et al. (2000) state in their first sentence that they intend to critique "implications of adopting the original 'ecological footprint' concept" with regards to aquaculture production. We were surprised to find our work included in their criticisms. We do not use the ecological footprint concept as developed and applied by Rees and Wackernagel (for example, Rees and Wackernagel, 1994). On the contrary, throughout the Roth et al.

paper we share many of the criticisms of the EF. In fact, along with many other authors, we have already commented on and discussed the EF concept in the published forum issue of *Ecological Economics*. In our contribution to the special issue (Deutsch et al., 2000), we clarified the objectives of our EF usage and how our perspectives differ from the developers of the EF method. Specifically, some of the critiques we mention in our commentary are that the EF as originally proposed: (i) is not appropriate for policy or management objectives; (ii) should use available local ecological data for calculations; (iii) is a static global budgeting approach and not an estimate of carrying capacity; and (iv) is not an indicator of sustainability as no economic or social indicators are included. Our commentary (Deutsch et al. 2000) complements our previous work and is quite clear on our approach. Previous articles also clarify our uses of the concept. It is therefore not justified that Roth et al. misrepresent our research. A careful reading of articles would clarify how we use the concept.

Interestingly, on p. 464, Roth et al. actually criticise us for not using the concept as Wackernagel et al. do: "the conceptualisation of an 'ecological footprint' in this setting is much different from the sustainability index properties originally embedded in the country-based 'ecological footprint' … described by Wackernagel and Rees (1996)". Yet they go on criticizing our research as though we have the same objectives. Let us just give a few examples of (1) misrepresentation of our work, and (2) misplaced criticism:

1. Misrepresentation

- Roth et al. (p. 463) state that "… suggesting that the "ecological footprint" can serve as a comprehensive planning tool is an overstatement of its potential". A specific reference would be appropriate here, as we have not suggested this.

- The authors further assert that management recommendations in our publications “are not in general agreement with well proven natural science or economic methodologies used to assess the viability and sustainability of modern and traditional aquaculture systems”. Firstly, we do not make any management recommendations based of EF, but simply present a tool for illuminating “hidden” requirements for ecosystem support. This is far from management. Secondly, the well-proven methodologies referred to have in many cases failed to predict viability of aquaculture operations, so there is certainly room for additional methods aiming at increasing sustainability.

- Roth et al. (p. 465) assert that we assume that calculated areas perform only a single function. We do not assume this. On the contrary, we discuss ecosystems as multifunctional systems in all our papers (e.g. Berg et al., 1996; Kautsky et al., 1997; Folke et al., 1998). Larsson et al. (1994) writes: “If several activities that use a mutual ecological system are to be compared by a spatial ecosystem support analysis, it must be established to what extent they overlap, and if so, whether they compete or supplement each other in order to avoid a misleading, mechanistic application of the method.”

- We have not published statements on, nor do we assert that the EF is appropriate to: develop “socially or economically responsible decision making and sound management practices, give an indication of the economic welfare gains derived from these activities, reach clear conclusions on either the optimum harvest decisions and the level of overfishing, or the trade-off between economic and social costs of transition,” as Roth et al. claim that we do (p. 466).

2. Misplaced criticism

- Roth et al. state (p. 463) that the EF concept has “inherent weaknesses, particularly in the lack of proper quantification methodologies for estimating the budgetary flows in dynamic, interactive ecological systems”. Folke et al. (1998, see pp. S64 and S69) plainly state: “Ecosystems are complex systems with nonlinearities, thresholds, and discontinuities (Costanza et al. 1993), but the footprint is a static measure.” (p S64) and “…as such, it does not capture the dynamic nature of changes in the ecosystem….”(p. S69).

- Roth et al. continue (p. 464) that the EF does “not in itself give the answer to whether the present system is ecologically sustainable or not”. We fully agree and have stated this in our publications, and thus find the criticisms awkward. The work of nature is expressed as an area to visualize our dependence on natural resources that we take for granted. Nature’s complexity cannot be reduced to a single dimension to be used as an operational indicator of ecological carrying capacity or sustainability or as a basis for a discussion on equity.

- In the first paragraph on p. 465, Roth et al. say that insufficient account of differences in husbandry practices (and degree of efficiency) is used in the calculation of the footprint. We realize that the analysis could be extended to include quantitative comparisons of resource usage and waste release between different practices, but we do not consider the EF approach to be suitable for any in-depth studies related to qualitative comparisons. We acknowledged this in Kautsky et al. (1997, see p.761): “These areas increase with the intensity of the cultivation and to some degree vary with the method and the species that is cultured”. Further, van den Bergh and

Verbruggen (1999, p.65) addressed the fact that the EF does not capture any qualitative dimensions. They concluded that intensive land usage, with small contribution to the EF, may cause high environmental pressure due to chemical usage, etc.

- Roth et al. (p. 465) criticize the addition of different uses to imply "equal weights for these functions both socially and ecologically". We do not give any weight to the different uses. The EF communicates human dependence on ecological life-support ecosystems alone. An EF analysis only identifies use of ecological areas. Where the ecological systems overlap, use conflicts may arise and trade-offs may be necessary. An EF analysis may help to identify areas of overlap, but additional tools are needed to assist in decision-making.

- Roth et al. (p. 465) claim that Larsson et al. (1994) conclude "that forms of production requiring larger 'footprints' are unsustainable." This is incorrect. The size of an EF describes the support area needed for the specific goods and services that are analysed. Larsson et al. compared areas used to areas available locally to gain an understanding of the level of dependence on external ecosystems. Further, comparing sizes of different production systems is only a first indication in an analysis. As previously discussed, qualitative considerations, not quantifiable in footprint calculations, must also be considered.

- In section 4.1.1, Roth et al. list three factors that they say reduce the credibility of the EF. We will here comment on the first as the other two has already been covered above. Roth et al. consider our choice of resources to be random. Implying that any resource could have been chosen, thus resulting in totally different EF estimates. This

statement shows the authors misinterpretation of our usage of EF, which is to illuminate the critical interactions of the combined system of humans and nature. We have chosen inputs crucial for production and outputs that have significant impacts on the performance of functioning ecosystems. Moreover, the suggestion to use primary productivity is perplexing. The EF for fishmeal is actually calculated using primary productivity estimates.

We could continue to comment on the limitations of the EF method much in line with the misplaced critique by Roth et al. of our work. What is surprising is that we have already stated the limitations in several articles published prior to the Roth et al. critique. We recommend for example a reading of Deutsch et al. (2000) instead.

Roth et al. conclude by describing how the EF could and should be used in aquaculture and this is actually how we have been using it. Our EF approach demonstrates that human activities, which at first glance may seem separated from nature, would not function without ecosystem support. EF is an excellent tool for communicating human dependence on life-support - nothing more or less. We welcome the call for a discussion among a wider scientific audience that the authors end their paper with, recognizing that such an academic forum has already taken place (*Ecological Economics* 2000). The authors' failure to acknowledge this, together with their misrepresentation of our work and inappropriate reference to us as "aquatic environmentalists" gives a less than scholarly impression.

References

Berg, H., Michelsen, P., Troell, M., Folke, C., Kautsky, N., 1996. Managing aquaculture for sustainability in tropical Lake Kariba, Zimbabwe. Ecol. Econ. 18, 141-159.

Costanza, R., Waigner, L., Folke, C., Mann, K.H., 1993. Modelling complex ecological economic systems: toward an evolutionary dynamic understanding of people and nature. BioScience 43, 545-555.

Deutsch, L., Jansson, Å., Troell, M., Rönnbäck, P., Folke, C., Kautsky, N., 2000. The "ecological footprint"- communicating human dependence on nature's work. Ecol. Econ. 32, 351-355.

Ecological Economics, 2000. Forum: The ecological footprint. Ecol. Econ. 32, 341-394.

Folke, C., Kautsky, N., Berg, H., Jansson, Å., Larsson, J., Troell, M., 1998. The ecological footprint concept for sustainable seafood production - a review. Ecol. Appl. 8. Suppl. 1, 63-71.

Kautsky, N., Berg, H., Folke, C., Larsson, J., Troell, M., 1997. Ecological footprint for assessment of resource use and development limitations in shrimp and tilapia aquaculture. Aquac. Res. 28, 753-766.

Larsson, J., Folke C., Kautsky, N., 1994. Ecological limitations and appropriation of ecosystem support by shrimp farming in Columbia. Environ. Manage. 18, 663-676.

Rees, W.E., Wackernagel, M., 1994. Ecological footprints and an appropriated carrying capacity: measuring the natural capital requirements of the human economy, pp. 362-390 In: Jansson, A.M., Folke, C., Costanza, R., Hammer, M. (Eds.), Investing in Natural Capital: the Ecological Economics Approach to Sustainability, Island Press, Washington, DC.

Roth, E., Rosenthal, H., Burbridge, P., 2000. A discussion of the use of the sustainability index: 'ecological footprint' for aquaculture production. Aquat. Living Resour. 13, 461-469.

van den Bergh, J., Verbruggen, H., 1999. Spatial sustainability, trade and indicators: an evaluation of the ecological footprint. Ecol. Econ. 29, 61-72.

Wackernagel, M., Rees, W., 1996. Our ecological footprint. Reducing human impacts on the earth. The New Catalyst Bioregional series, 9. New Society Publisher. Gabriola Island. BC, and Philadelphia, PA.