Letter to the Editor

Bradford, G. E. and R. L. Baldwin. 2003. Letter to the editor regarding S. Wirsenius's (Winter 2003) "The Biomass Metabolism of the Food System: A Model-Based Survey of the Global and Regional Turnover of Food Biomass," *Journal of Industrial Ecology* 7(1): 47–80.

We are writing in response to a recent article in Journal of Industrial Ecology: "The Biomass Metabolism of the Food System: A Model-Based Survey of the Global and Regional Turnover of Food Biomass", JIE 7(1): 47-80. The principal conclusion from the study is that ruminant animals are extremely inefficient in converting plant biomass to human food. We submit that this conclusion is biased by failure to take into account a number of relevant factors, and that it seriously misrepresents the contributions of this segment of agriculture to the human food supply.

Efficiency is calculated as output/input. Valid comparisons of different efficiencies depend on use of comparable inputs and outputs. In this paper, comparisons are made between items for which either the outputs or inputs, or both, are not comparable. For example, the outputs from pigs and poultry are meat, and meat and eggs, respectively, while those from ruminant livestock are not only meat and milk, but draft power for an estimated 50% of crop production in developing countries, transport, and other functions including recycling of plant nutrients. As a specific case, India has by far the largest population of cattle in the world, some 180 million, kept for milk, draft power, transport, fuel, fertilizer and cultural reasons, but little used for meat. Including all of their feed as inputs in calculating the efficiency of food production from ruminants clearly introduces a serious negative bias to that estimate. Furthermore, the inputs for non-ruminant and ruminant animals differ markedly. The feed for poultry and pork production contains a high proportion of potentially human-edible grains and protein supplements, while that for ruminants is predominantly human-inedible materials. Ruminant livestock convert materials that would otherwise not contribute to food production into high quality human food, and in the case of a number of by-products greatly reduce the volume of what otherwise would be waste products, with important environmental as well as economic benefits.

The additional functions of ruminants and the differences in feeds used for ruminant and non-ruminant production are in fact noted in the text, but not taken into account in the calculations and conclusions. The author notes, correctly, that ruminant and non-ruminant animals convert human-edible feed inputs to meat with similar efficiency, but rejects this as a valid basis for comparing efficiencies. He suggests instead using cultivatable cropland use as a basis of comparison. Based on the values presented in figure 7, 36% of the phytomass used as livestock feed comes from cropland, with the remainder from permanent grassland (which would not be harvested without grazing livestock). Estimating efficiency excluding feed from non-arable land would nearly triple the estimated efficiency of feed conversion by all livestock, with a much greater impact on estimated ruminant efficiency. However, in spite of the recommendation for this criterion, cultivatable land was not used in comparing

efficiencies or drawing conclusions. Such a basis would be a significant improvement over use of total phytomass (though in our view less so than use of human-edible inputs), but would neglect at least two relevant factors. One is that all arable land is not equal, and cultivated forages are often produced on land that is steeper, more erodable or otherwise less suitable for food crops. Secondly, food production per hectare from feed crops depends not only on conversion rate but also on crop yield. Feed crops such as alfalfa (lucerne) or maize (for silage or grain) when grown on good quality land have on average much higher yields than food crops grown on the same land (CAST 1999).

Ruminant animal production is an integral part of agricultural systems in many countries, complementing food crop production through use of crop residues and by-products, providing traction and fertilizer, producing food from land unsuited or less suited to crop production, and in other ways. While the rates of conversion of total phytomass to human food by ruminants are relatively low, the "efficiencies" presented in this paper are seriously misleading as to the contributions of ruminant livestock to human food quantity and quality. Demand for animal source foods is increasing rapidly in developing countries (Delgado et al. 1999) and there are documented nutritional benefits to people where intakes of these foods are low (Neumann et al. 2002). Thus the challenge is not to artificially underestimate the contributions of ruminant livestock, but to use their unique attributes to help increase the efficiency and sustainability of food production systems.

G. E. Bradford
Professor Emeritus
Animal Science Department
University of California
Davis, CA, 95616

R. L. Baldwin
Professor Emeritus
Animal Science Department
University of California
Davis, CA, 95616

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