Comparing the environmental impact of the US beef industry in 1977 to 2007

J. L. Capper, Department of Animal Sciences, Washington State University, Pullman, WA, USA

Historical livestock production is commonly perceived to be inherently more environmentally sustainable than modern agricultural practices. This study modeled the environmental impact of the 1977 US beef industry, which produced 10.6 billion kg beef from 38.7 million head slaughtered, compared to that of 2007 (11.9 billion kg beef produced by 33.7 million head). The deterministic environmental impact model integrated resource inputs and waste outputs from animal nutrition and metabolism, herd population dynamics and cropping parameters using a modified life cycle assessment approach. Rations were formulated according to a scientifically and commercially-accepted animal nutrition model (AMTS Cattle.Pro) for growing animals (steers, heifers) and the supporting population (cows, bulls, herd replacements) according to production level (growth, pregnancy, lactation) at breed-appropriate bodyweights. System boundaries extended from the cow-calf operation to arrival at the slaughter plant, thus all operations and transport within these limits were included. Resource inputs included feedstuffs, water, land, fertilizers and fossil fuels. Waste outputs included manure and greenhouse gas emissions. The total animal population required to produce one billion kg of beef in 2007 was reduced by 31% compared to 1977. This difference was conferred both by improved supporting population productivity over the time period and by dairy calves entering the beef production chain to be finished as slaughter animals, thus reducing the number of support animals required. A combination of the decrease in population size and improved productive efficiency between 1977 and 2007 conferred reductions in total feed energy and feedstuff use of 10% and 20% respectively. Total land area (pasture/rangeland and cropland) required to support beef production was reduced by 30%. Water use per billion kg beef was reduced by 14% between 1977 and 2007. Compared to the 1977 beef industry, fossil fuel energy for beef production was reduced by 9% per unit in 2007. Methane and nitrous oxide emissions per billion kg beef produced in 2007 were reduced by 21% and 13% respectively. The total carbon footprint (expressed as CO_2-equivalents per billion kg beef) was therefore reduced by 18% in 2007 compared with 1977. This

analysis clearly demonstrates that advances in US beef industry productivity conferred by improvements in slaughter weight, growth rate, nutrition and management have considerably reduced the environmental impact of modern beef production, thus improving the sustainability of livestock production.

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