A recent study, “Feed conversions, ration compositions and land use efficiencies of major livestock products in U.S. agriculture system” (feed conversion study), explored the environmental impact of raising livestock on land.1 The study analyzed feed needs and ration composition throughout all stages of livestock life to determine feed and land use efficiency of livestock production. The study compared a range of different livestock that produce varying foods and require varying qualities and quantities of land.

The study included both ruminant livestock — plant-eating animals with a four-chambered stomach, such as cows, sheep and goats — and monogastric species — omnivores with a single-chambered stomach, such as chickens, turkeys and pigs. Ruminant animals generally require more land than do monogastric animals. These differences in land use requirements exist because of differences in how efficiently animals convert what they eat (feed) into human food. This conversion effectiveness is measured in terms of grams of protein or kilocalories of energy.

In addition, meat from ruminant livestock is generally associated with greater greenhouse gas emissions per unit product because of the methane gasses released during digestion. Much of the plant material that ruminant animals consume comes from grazing land, where crops replenish themselves from year to year. Output of humanly edible food from such livestock may actually be higher than from animals that do not consume plants or grain.2

**METHODOLOGY**

Feed conversion rations, aggregate ration composition and land requirements for each livestock class were calculated in the feed conversion study using a five-step approach:

1. Determine major life phases and the relationships between them for each class of livestock.
2. Calculate values for each stock and flow based on rates of reproduction, mortality and culling of livestock classes.
3. Estimate feed and ration compositions for individual life phases of each livestock class. Balance rations to meet the nutrient needs of each life phase within each livestock system using a simplified list of possible ingredients: corn grain, soybean meal, corn silage, alfalfa silage, grass hay and graze forage.
4. Summarize findings by tabulating total intake of food across all life stages within each livestock class and averaging edible output per individual animal.
5. Convert feed needs to the area of land required per individual animal.

**RESULTS**

The feed conversion study found that the efficiency of feed use and land requirements in livestock production varies widely. However, the differences in land requirements for various types of livestock production are more nuanced when quality of land required to supply each food ingredient is considered. Feed use efficiency varies widely among the major livestock systems. Meat produced from beef breeds has the largest overall feed requirements. There is also an abrupt increase in feed requirements for meat-producing livestock when converting from a live weight to an edible weight basis, which reflects the removal of blood, bone, feathers, hair, hide and viscera from the animals. The remaining six products also display a wide range of variation in feed conversion ratios.

As shown in the figure above, aggregate ration composition also varies widely between ruminant and monogastric animals. Monogastric animals obtain all energy and protein needs from corn grain and soybean meal, whereas ruminant animals require hay, silage and grazed forages. Among monogastric animals, chickens and pigs are similar in that they meet a higher proportion of their feed needs from corn than do turkeys.

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2 Ibid.