Whole farm nutrient imbalances are common for modern livestock operations.

To be environmentally sustainable, a livestock or poultry operation should attempt to achieve a whole farm phosphorus balance of 1:1.

Typical Nutrient Balances

The nutrient balance is illustrated for a feedlot, dairy, and swine operation in Figure 2-4. For this feedlot, the input to output ratio was 2.5:1 for N (imbalance of 650 tons/year) and 2:1 for phosphorus (P) (imbalance of 120 tons/year). The magnitude of the imbalance is smaller for the dairy and swine operation. However, the ratio of inputs to outputs ranges from 2.5:1 to more than 4:1. Inputs to outputs ratios of 2:1 up to 4:1 are common for many livestock operations.

Size is generally a poor indicator of the nutrient imbalance experienced by livestock operations. A review of the whole farm nutrient balance for 33 Nebraska swine confinements and beef feedlots did not observe a trend between an increasing imbalance and larger livestock operations (Figure 2-5). Many of the operations involved in this study experienced a P balance near the ideal 1:1 ratio while some exceeded ratios of 4:1. Several of the worst imbalances were observed for livestock operations with less than 1,000 animal units.

A P balance provides a preferred indicator of the risk to water quality. An imbalance in N does not distinguish between the relatively benign losses (e.g., denitrification of nitrate to N_2 gas) and the relatively harmful environmental losses (e.g., nitrate loss to water). In contrast, P losses impact only water quality through increased soil P levels and greater concentration of P moving with surface runoff water.

Farms with a P input to output ratio near 1:1 ("Low Risk" group in Figure 2-5) have the potential to be environmentally sustainable. Since soil storage is the primary reservoir for P, average soil P level should not be increasing for an input:output ratio near 1:1. If manure is managed appropriately within the available land base, the nutrient-related water quality risk should not be increasing.

Livestock and poultry operations with a large imbalance (1.5:1 and greater) would expect steadily increasing soil P levels. Runoff and erosion from land application sites will carry an increasing P load as soil P levels increase. Measures to reduce runoff and erosion will partially reduce this risk and provide temporary solutions. The P imbalance must be corrected before this growing pollution potential will stabilize. These "High Risk" operations are not environmentally sustainable.

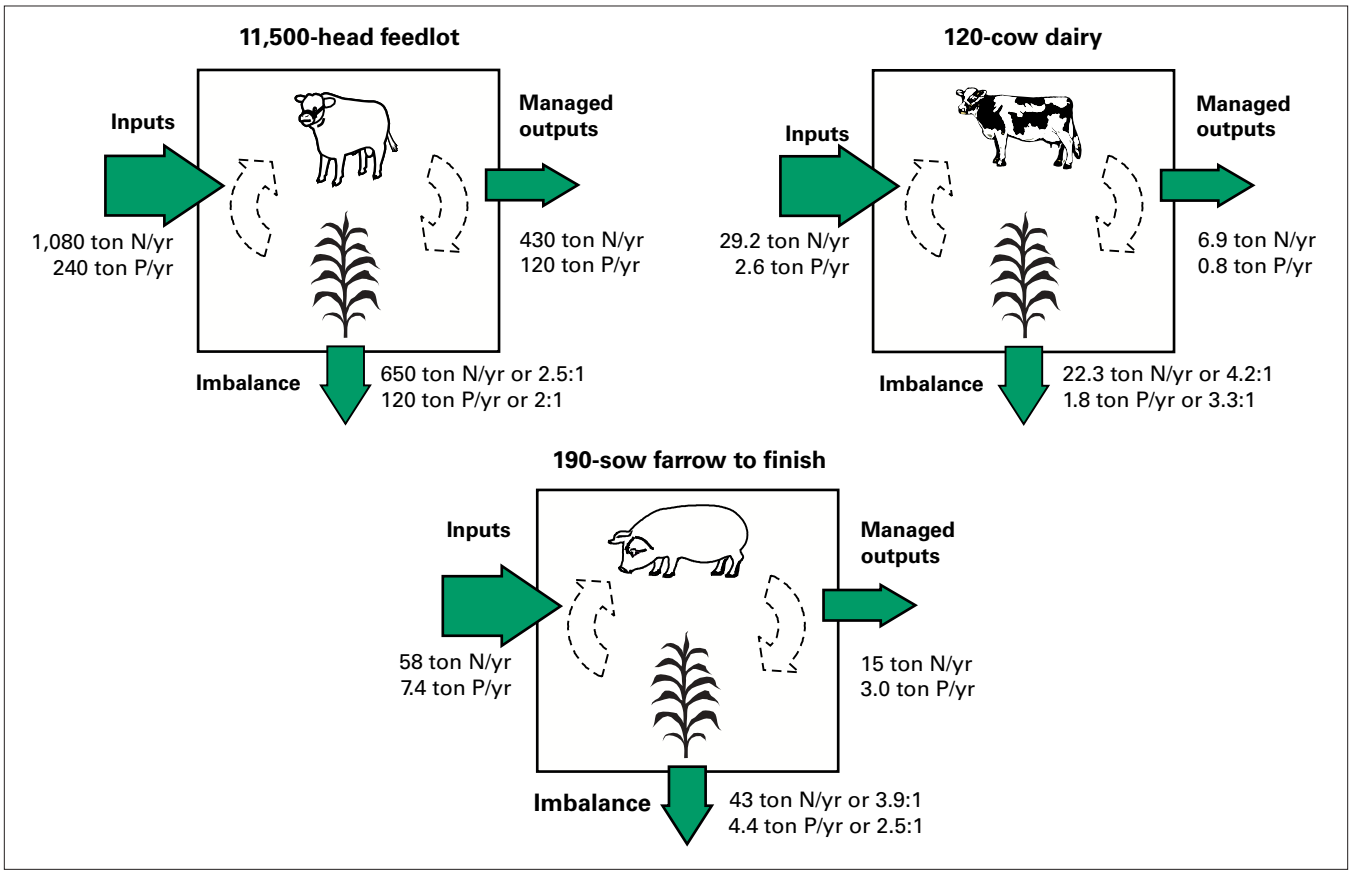

Figure 2-4. Typical nutrient imbalance observed for different livestock systems (Koelsch and Lesoing 1999 and Klausner 1995).

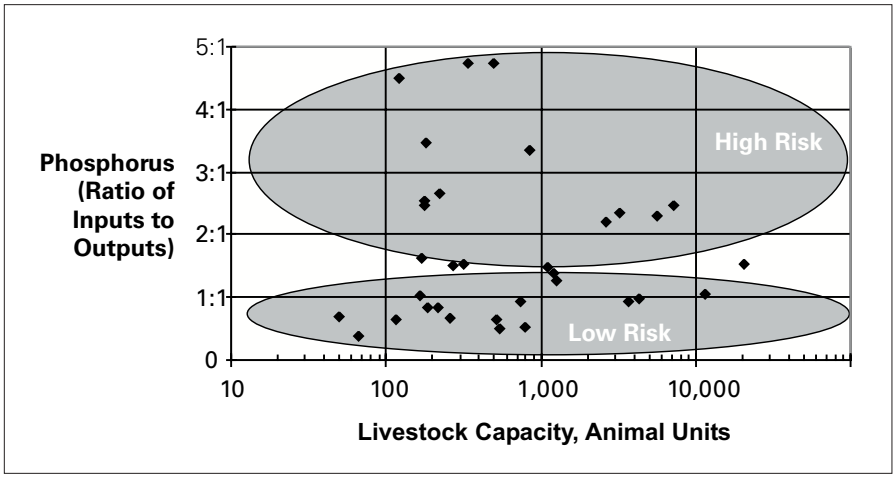

Figure 2-5. Phosphorus balance vs. size for 33 Nebraska livestock operations (Koelsch and Lesoing 1999).