order approximation of areas where technology developed and demonstrated in one location might be adaptable to others. The method is not intended to necessarily be highly correlated with the location of actual dairy operations on other locations. This is because there are factors other than geographic equivalence that dictate the presence of dairy operations in places other than where the technology package was evaluated. We recognized that such non-modeled factors as disease and disease vector prevalence would limit the development of dairying in areas that are geographically similar to modeled zones in Kenya. We also recognized that there would be areas where dairying would exist in response to market pressures that overcome limitations in available natural resources. In these limited assessments, we found evidence of these several factors other than geographic equivalence to areas in Kenya that also influence the development and presence of dairying operations in Uganda and Tanzania.

The analysis shown in Figure 3.2.4-2 assisted in identifying the most relevant areas of data gathering by combining smallholder dairy farm activity with the Kenyan equivalent dairy zones. The limit to the methodology is apparent in the inability of the ACT method to identify the highly productive dairy zone in the Kabale district in southwestern district. The methodology did identify the Mbarara region (horticulture in Kenya) in southwestern Uganda as a major smallholder dairy zone under a horticulture environment. More detailed study showed that the region is comprised of pastoral and extensive dairy producers. However, the area is too dry for intensive dairy production. These exceptions verify that on-ground expertise is essential to add to other relevant variables for a more complete geographical extrapolation across regions to properly characterize production zones. The Kenya extrapolation did capture a great deal of the environmental characteristics and provided a useful tool for making an initial assessment of the appropriate target areas for stratification and selection of representative farms.

Overlaying the cattle density (Figure 3.2.4-3) with similar agriculture zones and road networks (Figure 3.2.4-4) provided a means of identifying which areas of potential development have a high probability of successfully linking into the national dairy marketing system (Figure 3.2.4-4). Further refinements in the production zones were possible using this “trimming” method to better represent actual production zones for smallholder dairying.

3.2.5 Defining Yields from Biophysical Models

After identifying the potential areas of dairy production, regional forage production profiles of existing and potential (new) adoption were modeled to link climatic clusters to provide a geographic identity to areas suitable for production of Napiergrass for forage. Representative farms were selected for intensive survey and characterization of biophysical conditions and livestock/crop enterprises. PHYGROW, a biophysical forage production model, provided the estimates of variation in forage yields and feeding values for each of the Ugandan agro-ecological zones using the conditions observed on the stratified representative farms. The various breeds of cattle used in smallholder dairying were then input into the NUTBAL nutritional balance analyzer to determine the annual crude protein requirements, net energy requirements and dry matter intake reflecting temporal changes in forage quality, environmental conditions and animal physiology. These values were used to produce enterprise budgets and agricultural sector analyses for the assorted production systems in each agro-climatic zone. In addition, many of the major crops grown in Uganda were biophysically simulated with the Environment Policy Integrated Climate (EPIC) model for each of the major production zones as characterized by management practices noted in the representative farms. Nine crops were included in the model: cotton, millet, maize, sorghum, rice, bananas, beans, groundnuts, and simsim.
Figure 3.2.4-3. Comparison of Almanac Characterization Tool (ACT) derived small holder dairy environments in Uganda with small scale dairy cattle densities at the regional level.
Figure 3.2.4-4. Location of major roads and Almanac Characterization Tool (ACT) derived small holder dairy environments in Uganda.