3.2.4 Geographic Description of Dairy Zones to Establish Sampling Frames and Comparison to Dairy Zones in Kenya

A spatially explicit, geographic equivalence analysis was used to differentiate homogeneous agricultural climatic zones. This formed the basis for selecting the regions suitable for data gathering and farmer interviews. Uganda is modeled as four regions including: 1) the semi-arid dry North, 2) the semi-arid East, 3) the moist lake, Crescent zone near Lake Victoria (Central), and 4) the semi-arid Western province. Two dairying regions differed in terms of agro-ecological zones from those delineated in the Kenya zones; the lake crescent zone (Central region) and the Western Highlands which include the highly productive stream fed pastures in the Kabale district. Figure 3.2.4-1 provides a description of the cattle densities by region. Note the higher cattle densities in the southern and western regions where higher moisture conditions prevail.

An important part of the process of determining how well the Kenyan dairy technologies can be transferred to Ugandan was to identify which regions of Uganda had similar dairy production potential as Kenya. Figure 3.2.4-2 describes the regions that correspond to similar ecological and economic environments in Kenya.

The concept of geographic equivalence was recognized to be limited to the identification of areas in Uganda and Tanzania that have similar geographic features to those defined in Kenya. The method provides a first
Figure 3.2.4-1. Small scale dairy cattle density (number/km²) in Uganda.
Figure 3.2.4-2. Location of small holder dairy environments in Uganda with similar ecological and economic environments to that examined in Kenya (with the exception of Kampala environment).
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.