The processes of nutrient depletion and soil degradation that limit productivity of smallholder African farms are spatially heterogeneous. Causes of variability in soil fertility management at different scales of analysis are both biophysical and socio-economic. Such heterogeneity is categorized in this study, which quantifies its impact on nutrient flows and soil fertility status at region and farm scales, as a first step in identifying spatial and temporal niches for targeting of soil fertility management strategies and technologies. Transects for soil profile observation, participatory rural appraisal techniques and classical soil sampling and chemical analysis were sampled across 60 farms in three sub-locations (Emuhaia, Shinyalu, Aludeka), which together represent much of the variability found in the highlands of western Kenya. Five representative farm types were identified using socio-economic information and considering production activities, household objectives and the main constraints faced by farmers. Soil fertility management and nutrient resource flows were studied for each farm type and related to differences in soil fertility status at farm scale. Farm types 1 and 2 were the wealthiest; the former relied on off-farm income and farmed small pieces of land (0.6–1.1 ha) while the latter farmed relatively large land areas (1.6–3.8 ha) mainly with cash crops. The poorest farm type 5 also farmed small pieces of land (0.4–1.0 ha) but relied on low wages derived from working for wealthier farmers. Both farm types 1 and 5 relied on off-farm earnings and sold the least amounts of farm produce to the market, though the magnitude of their cash, labor and nutrient flows was contrasting. Farms of types 3 and 4 were intermediate in size and wealth, and represented different crop production strategies for self-consumption and the market. Average grain yields fluctuated around 1 t ha^{-1} $year^{-1}$ for all farm types and sub-locations. Grain production by farms of types 4 and 5 was much below annual family requirements, estimated at 170 kg $person^{-1}$ $year^{-1}$. Household wealth and production orientation affected the pattern of resource flow at farm scale. In the land-constrained farms of type 1, mineral fertilizers were often used more intensively (ca. 50 kg ha^{-1}), though with varying application rates (14–92 kg ha^{-1}). The use of animal manure in such small farms (e.g. 2.2 t $year^{-1}$) represented intensities of use of up to 8 t ha^{-1}, and a net accumulation of C and macronutrients brought into the farm by livestock. In farms of type 5, intensities of use of mineral and organic fertilizers ranged between 0–12 kg ha^{-1} and 0–0.5 t ha^{-1}, respectively. A consistent trend of

decreasing input use from farm types 1–5 was generally observed, but nutrient resources and land management practices (e.g. fallow) differed enormously between sub-locations. Inputs of nutrients were almost nil in Aludeka farms. Both inherent soil properties and management explained the variability found in soil fertility status. Texture explained the variation observed in soil C and related total N between sub-locations, whereas P availability varied mainly between farm types as affected by input use.