

The introduction of irrigation into a pastoral system creates new water demands. These new water demands change the water balance. This study in Kalacha settlement of Marsabit District, analyzed whether the available water was sufficient for both livestock and crop requirements and what tradeoffs options the people had in the usage of a fixed supply of water.

Water quality was measured by standard laboratory practices, while flow rate was measured with a flat plate weir. Crop water requirements were calculated from evaporation data. Animal water requirements were calculated as (a) that based on maximum stocking density (b) the stock dependant on forage produced by irrigated crops and (c) those counted by past aerial surveys. Simulation and optimization modeling methods were used with respect of either crop or livestock to provide nutritional needs of residents and establishment of tradeoffs in water use. Results of the study indicated that water supply was 795,000 litres per day (L/D), with a human demand of 28,700, wildlife; 26,475, livestock; 7 to 552,225 L/D while the crop demand; 95,040 to 319,680 L/D. The water balance ranged from negative 259,505 to positive 644,778 L/D. Simulations also indicated that requisite area to achieve community's energy needs (39ha) was higher than that topographically available (7.2). Additionally, that scheduling of irrigation was inadequate due to varying soil infiltration capacity (1.066 to 1.5 nun/min). High energy crops were of generally long growth- periods thereby competing with livestock. Short growing period plants provided livestock with an opportunity window as a trade off, while long growth period plants and intensification reduced it. Further, plants with both high biomass yield for livestock and human energy needs were inefficient water users and were unable to satisfy community's energy requirements despite intensification. Crops however, produced more nutritional energy on weight basis of water consumed. Livestock simulation indicated that 537 goats were necessary for milk production to meet the community energy requirements, while 103 cattle were required for meat production. Whereas the numbers of shoat were within the aerial survey counts, the number of cattle was too close to aerial counts (180) implying use of cattle meat is unsustainable. Sheep however, were the most efficient users of water for each weight gained (98.05kg/m³) followed by camel (17.7kg/m³), goat (42.575kg/m³) and cattle (11.327kg/m³), in that order. For each lactating animal, camels produce more milk (0.11 to 0.46kg/kg), followed by shoats (0.025 to 0.2075kg/kg /kg) then cattle, Shoats have the lowest water capital cost for milk production (81 to 22 3kg), then camel (711 to 5438kg) and cattle(1188 to 1998kg)in that order. In conclusion optimal range stocking resulted in a water deficit. Surplus occurred in scenario (b) and (c). Also, that the water was generally unsuitable for use by irrigation (332.61 mg/l Cl⁻) livestock (SO₄²⁻) and humans (SO₄²⁻, K⁺). By cultivating salt tolerant crop and another well, irrigation has some prospect. Despite irrigation's greater energy production, pastoralism performs better than irrigation in the dry lands. A holistic policy is requisite for negotiations and trade offs between competitors, for the scarce water.