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Soil quality indicators across different agro-ecological zones of Mt. Kilimanjaro, Tanzania

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Introduction The agroecosystems at the southern slope of Mt. Kilimanjaro have been an important resource for the provision of ecosystem services, in particular food production. However, their potential is increasingly threatened by a rapid change in agricultural land use and its future sustainability remains uncertain. Various efforts to achieve sustainable management of agroecosystems have not been successful and therefore there is a risk of land degradation and poverty. This problem is attributed to a lack of knowledge about the actual causes and extent of the problem among local farmers, extension officers and researchers, thus limiting decision options on the selection of appropriate adaptation measures.

Goals Therefore, we conducted a study to determine how changes in traditional farming systems affect soil quality within the agroecosystem at the southern slopes of Mt. Kilimanjaro.

Material and Methods We measured C, N, P, soil texture, bulk density and the cation exchange capacity (CEC) in 24 plots across major agro-ecological zones (mainly related to elevation) and in two farming systems (maize and agroforestry).

Results We found that sand content increased, clay content and bulk density decreased with increasing elevation. C content was slightly lower in maize compared to agroforestry (-0.88%), but not N and P. C and N contents increased in the upper compared to the lower elevation zones (3.8% and 0.3%, respectively), while P decreased by 19 mg/kg. The content of cations from CEC showed a heterogeneous picture. The largest difference was the decrease of Ca and Mg in the upper elevation zone (-1191 mg/kg and -458 mg/kg, respectively).

Conclusions Soils in the agroecosystems of Mt. Kilimanjaro differ in their properties which implies that crop yield and quality could be higher on some plots than others. Therefore, the vulnerability to food insecurity and efforts required to improve soil quality could vary locally. The use of soil quality indicators would benefit both farmers and extension officers as a decision-making tool to identify suitable locations for crops, achieve precise use of production inputs and manipulate crop

calendars.