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Soil Erosion Risk Assessment in Uganda

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Land use without adequate soil erosion control measures is continuously increasing the risk of soil erosion by water mainly in developing tropical countries. Uganda is prone to environmental disturbance due to high population growth and high rainfall intensity. The aim of this study was to assess the state of soil erosion by water in Uganda at national and district levels, for various land cover and land use (LCLU) types, in protected areas as well to predict the impact of support practices on soil loss reduction.

Predictions obtained using the Revised Universal Soil Loss Equation (RUSLE) model indicated that the mean rate of soil loss risk in Uganda's erosion-prone lands was 3.2 $t \cdot ha^{-1} \cdot y^{-1}$, resulting in a total annual soil loss of about 62 million tons in 2014. About 39% of the country's erosion-prone lands were comprised of unsustainable mean soil loss rates >1 $t \cdot ha^{-1} \cdot y^{-1}$. Out of 112 districts in Uganda, 66 districts were found to have unsustainable estimated soil loss rates >1 $t \cdot ha^{-1} \cdot y^{-1}$. Six districts in Uganda were found to have mean annual soil loss rates of >10 $t \cdot ha^{-1} \cdot y^{-1}$: Bududa (46.3 $t \cdot ha^{-1} \cdot y^{-1}$), Kasese (37.5 $t \cdot ha^{-1} \cdot y^{-1}$), Bundibugyo (28.9 $t \cdot ha^{-1} \cdot y^{-1}$), Bulambuli (20.9 $t \cdot ha^{-1} \cdot y^{-1}$), Sironko (14.6 $t \cdot ha^{-1} \cdot y^{-1}$) and Kotido (12.5 $t \cdot ha^{-1} \cdot y^{-1}$). Among the LCLU types, the highest soil loss rates of 11 $t \cdot ha^{-1} \cdot y^{-1}$ and 10.6 $t \cdot ha^{-1} \cdot y^{-1}$ were found in moderate natural forest and dense natural forest, respectively, mainly due to their locations in highland areas characterized by steep slopes ranging between 16% to 21% and their high rainfall intensity, ranging from 1255 $mm \cdot y^{-1}$ to 1292 $mm \cdot y^{-1}$.

Only five protected areas in Uganda were found to have high mean estimated mean soil loss rates >10 $t \cdot ha^{-1} \cdot y^{-1}$: Rwenzori Mountains (142.94 $t \cdot ha^{-1} \cdot y^{-1}$), Mount Elgon (33.81 $t \cdot ha^{-1} \cdot y^{-1}$), Bokora corridor (12.13 $t \cdot ha^{-1} \cdot y^{-1}$), Matheniko (10.39 $t \cdot ha^{-1} \cdot y^{-1}$), and Nangolibwe (10.33 $t \cdot ha^{-1} \cdot y^{-1}$). To manage soil erosion in Uganda's protected areas, there is an urgent need to control wildfires and human-induced disturbances such as timber harvesting and soil compaction from domestic animals.

Our study analysis revealed that well-established terraces and strip-cropping could significantly reduce soil loss rates in Uganda's croplands by 80% (from 1.5 $t \cdot ha^{-1} \cdot y^{-1}$ to 0.3 $t \cdot ha^{-1} \cdot y^{-1}$) and by 47% (from 1.5 $t \cdot ha^{-1} \cdot y$ -1 to 0.8 $t \cdot ha^{-1} \cdot y^{-1}$), respectively, well below the sustainable soil erosion tolerance rate (1 $t \cdot ha^{-1} \cdot y^{-1}$) for land and water conservation.