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A GIS-Based approach for identifying suitable sites for rainwater harvesting technologies in Kasungu District, Malawi

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Kasungu district in Malawi is affected by erratic rainfall characterised by dry spells. Each year the district receives unevenly distributed rainfall hence threatens crop production. Soil moisture retention is vital in crop production hence rainwater harvesting (RWH). The Malawi Government has advocated for RWH. Proper planning in identification of suitable sites for RWH still remains a challenge. The objective of this study was to develop a GIS-based approach for identifying suitable sites for RWH technologies in Kasungu District of Malawi. Secondary data was collected from desktop sources such as reports, socio-economic survey documents of the area, maps, and reports from government departments. Field surveys were conducted in the villages of Chipala Extension Planning Area (EPA) were the RWH is widely practiced, in order to identify and evaluate performance of existing RWH interventions, and to establish factors for locating suitable areas for RWH. Observed soil moisture content was used to test for performance of RWH technologies. The one way Analysis of Variance (ANOVA) was used to test for the significance difference (α=0.05) of amount of moisture measured in the technologies. A GIS based model using the Soil Conservation Service (SCS) Curve Number method combined with socio economic and environmental factors was used to map runoff potential areas for RWH. The field survey showed that various types of RWH technologies were implemented in the study area with the most commonly implemented technology being soil mulching (50 %), contour tied ridges (39 %), planting pits (7 %) and infiltration pits (4 %). Results of field observation on soil moisture content indicated that the average seasonal amount of soil moisture was highest under soil mulching treatment (24.4 % by volume) followed by contour tied ridging treatment (22.2 % by volume) and was least under conventional practice which was used as a control (11.4 % by volume). The ANOVA results showed that there was a statistically significant difference in the moisture measurements for the three treatments (P< 0.05). From the generated suitability map for the study area it was found out that 0.2 %, 33.5 %, 55.9 %, 10.1 % and 0.3% of land were very high, high, moderate, marginally and not suitable respectively for in field RWH. These results showed that overall 87% of the land in the study area being suitable for RWH. The model was validated by comparing locations of existing RWH technologies to the suitability map that showed that 81 % of RWH technologies were located in the high suitable area and moderate areas, 15 % in areas of low suitability whilst only 4 % were located in areas of very low suitability. Hence the model can reliably be used to identify suitable areas for RWH technologies.

Keywords: RWH, GIS, SCS, Contour tied ridging and Soil mulching