

Spatial Modelling and Assessment of the Sustainability of Rain-fed Agriculture Using Dry-Spell Analyses - A Case Study of Pangani River Basin, Tanzania -

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Sustainability of rain-fed agriculture in the Pangani Basin was assessed using dry-spell analysis based on the soil moisture balance in the root zone. Three main crops commonly grown in the basin were considered (maize, rice and beans). One crop was taken at a time and the soil moisture balancing was calculated for each grid resolution of 1 km by 1 km and analysed across the given rainfall record. The analysis was done for independent regions, subdivided on the basis of homogenous rainfall regimes. After that, the probability of dry-spell obtained for each grid in the delineated homogeneous regions was merged to estimate the interpolated probability surface (or map) for the basin.

The results indicate that maize could be produced under rain-fed agriculture in parts of the basin, whereas the production of beans might be sustainable under rain-fed irrigation in the entire basin. However, it might be practically impossible to grow rice without supplementary or total irrigation. Thus, one can conclude from the analysis that mixed agriculture based on supplementary irrigation is the sustainable development option in the Pangani Basin. The calculated probability indices can also be used as one of the policy variables in multi-objective, multi-criteria water resources allocation problems. Similar studies could be conducted in Ethiopia to highlight and rank the priority intervention areas and further develop early warning systems.