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Participatory soil mapping in Benin, supported by gamma ray measurement

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Abstract

Developing land evaluation and decision support tools relies on sound data about the environment, including soils. In particular, if future options for land use at village level need to be decided, a participatory approach that is based on local terminology may be essential to bridge the language divide between farmers and researchers, and ensure effective communication. However, the level of local populations' soil knowledge is quite variable and depends to a large extent on the settlement history. Therefore, it is more secure to base a soil map not only on local knowledge, but also on additional observation or measurements. Gamma ray spectrometry has been shown to be a good and easily applicable tool for the collection of soil information using proximal sensing. In this case study in the village of Boukoussera basement region, close to Parakou, Benin, gamma ray measurements were conducted in order to verify the indigenous soil map that had initially been produced by local expert interviews. The sequence of working steps for the map establishment was as follows: 1. Indigenous soil mapping based on satellite images interpreted by local experts. 2. Soil profile description within the key units and reference gamma ray measurements. 3. Measurement of gamma ray properties in the village territory in a multiple zigzag pattern, assisted by soil augering. 4. Cluster analysis of gamma/augering data. 5. Adjustment of indigenous soil map based on the cluster results. 6. Verification of the map on the ground with local experts. 7. Final elaboration of the map based on GIS technology. The results show that the local soil types included Jaaleri, Baaduni, Taaduni and Loope. However, the gamma measurements indicated that there could be two different types of Loope, which are potentially differentiated by their inherent clay content. Site assessment and soil augering enabled the differentiation of Jaaleri into deep Jaaleri and shallow Jaaleri (around rock outcrops). Using cluster analysis, the indigenous soil map was readjusted into 7 units. These will be assessed further to produce the final soil map.

Keywords: Boukoussera, conventional soil mapping, gamma spectroscopy, indigenous soil mapping, participatory mapping, proximal sensing