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Participatory soil mapping at village scale, supported by gamma ray measurement: A case study of Boukoussera, Benin

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Abstract

Data on the spatial distribution of soil and its properties is either unavailable or very inadequate at village scale in much of West Africa. However, it is needed in order to fight land degradation, and to support local and administrative purposes like the new initiative to develop a cadastral land register in Benin. Conventional soil mapping is, nevertheless, capital, time and labour-intensive. As such, there is a need for a simple, fast, and cheap approach that responds to the local needs and knowledge as well as official and scientific purposes. In this paper, we present a case study of Boukoussera village in Benin Republic that is based on a participatory approach, but aided by proximal sensing of the natural gamma signal of soils. The cartographic units are, based on the indigenous soil classes, but the delineation was proven by a fast, easy, and reproducible approach relying on scientific standards. Indigenous soil types were first documented using local expert interviews. These experts then mapped the cartographic units on a high-resolution satellite image and indicated places for the reference soil pits. These were described and classified according to the World Reference Base for Soil Resources (WRB). Samples were taken and analysed in the laboratory to determine basic physical and chemical properties. Subsequently, natural gamma radiation across the village territory was registered along a flexible zig-zag grid with an easy-to-use hand-held device. The cluster analysis of these proximal data was used to update the indigenous soil map generated by the villagers. This was latter reassessed on the ground by villagers using transect walks aided by soil augerings. The resultant map has 4 major units, namely, Loope, aduni, Taaduni, and Jaaneri. These indigenous soil types, respectively, represent the following Reference Soil Groups (RSG) in the WRB: Gleysol, Plinthosol, Acrisol, and Lixisol. These RSGs reflect different limitations with respect to rooting, inundation, and nutrient availability.

Keywords: Cartography, ethnopedology, gamma spectrometry, land use planning, local knowledge, proximal sensing

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