Participatory soil mapping in Benin assisted by gamma spectrometry

Chike Onyeka Madueke[1], Attanda Mouinou Igue[2], Ludger Herrmann[1]

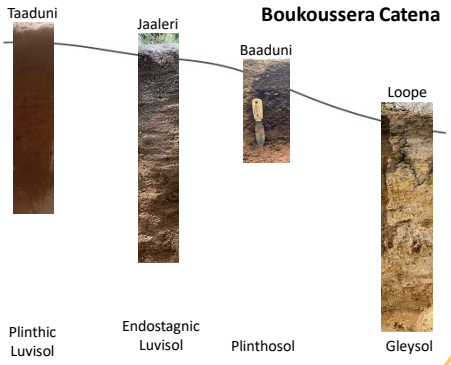
[1] *Institute of Soil Science and Land Evaluation, University of Hohenheim, Stuttgart, Germany.*
[2] *National Institute of Agricultural Research of Benin, Benin Republic*

Background

- Under the threat of **climate change** and other hazards, sufficient knowledge about the **natural resources of indigenous populations** should be mandatory.
- In that respect, **soils** are often neglected objects, since they are hard to explore and quantify. But they are the basis of all agricultural production.
- Therefore, a **fast approach** / technology that allows us to map this resource is of fundamental importance.
- Such an approach is provided here, by combining satellite imagery**, indigenous knowledge**, and **gamma spectrometry** at the village scale level.
- The **local participation** helps to bridge the language/ knowledge divide between rural farmers and researchers/extension agents.

Main results

- The indigenous soil types in Boukoussera include Taaduni, Jaaleri, Baaduni, and Loope.
- Further differentiation was possible through field mapping, gamma spectrometry and cluster analysis.



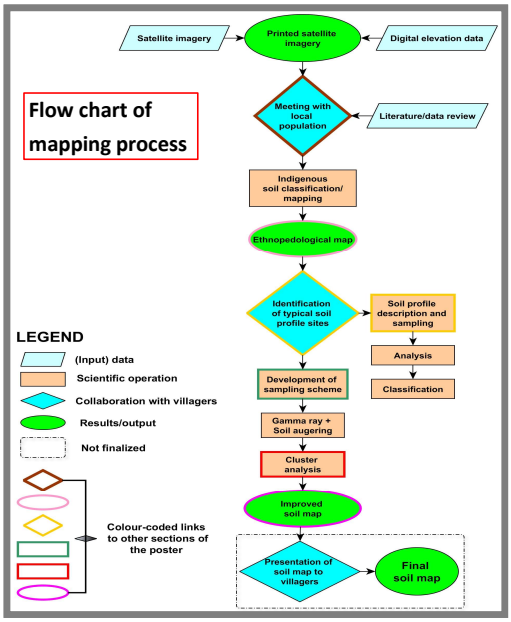
Conclusions

- In particular, in cases of limited time or indigenous knowledge, gamma spectrometry assisted soil mapping allows us to gain a fast overview of existing resources in a sufficient spatial resolution and detail for land use planning.
- Gamma mapping needs a medium investment (ca. 5000€ for the instrument) but very little education.
- In the best case, detected soil units are supported by laboratory analyses.
- Useful additional information are petrography and topography.
- Mandatory for the final soil map is the approval by the local population.
- Users can choose the spatial and content-wise level of detail and add information layers like property boundaries, etc..

Methodology

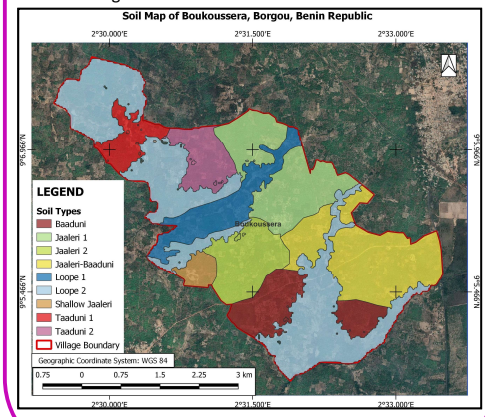
- The study uses an updated approach that was basically developed by Reinhardt and Herrmann (2017).

Reinhardt, N. and L. Herrmann (2017): Fusion of indigenous knowledge and gamma spectrometry for soil mapping to support knowledge-based extension in Tanzania. *Food Security* 9: 1271-1284.



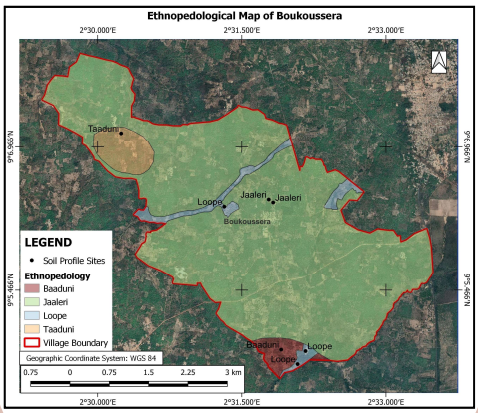
4. Improved soil map

- By adding field and topographic information, it was possible to delineate nine units that are now being checked through laboratory analyses and discussion with villagers.



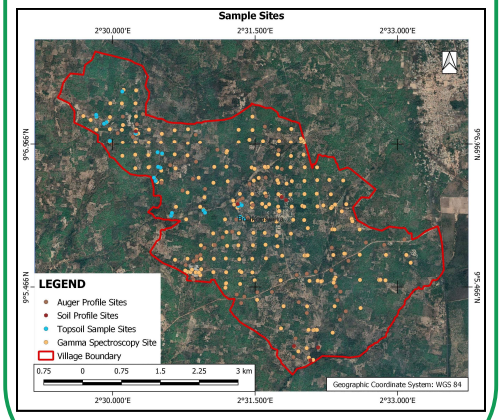
1. Ethnopedological map

- With our rapid approach (ca. 3h) based on key informant interviews, only basic soil units could be distinguished and key occurrences mapped.



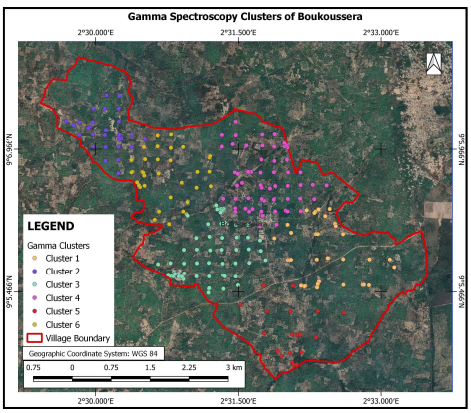
2. Sampling scheme

- Depending on the peculiarities encountered in the field a flexible grid was chosen as sampling scheme in order to spare time but allow for sufficient spatial resolution.



3. Cluster analysis

- Cluster analysis of the gamma ray readings enabled the distinguishing of six different mapping units, in tandem with the indigenous ones.



Acknowledgement: We are grateful to the BMBF for providing the funds required for the successful execution of the DecLaRe project. We are also grateful to the Agronomy department of the University of Parakou, Benin, for the support and linkages provided on-site. Also worthy of our immense gratitude for their hospitality and cooperation, are the chief and village elders of Boukoussera community.

Tropentag 2023:
Competing pathways for equitable food systems transformation: trade-offs and synergies (September 20 - 22, 2023) organised by the Leibniz Centre for Agricultural Landscape Research (ZALF), Germany in cooperation with Humboldt-Universität zu Berlin, Germany

Bundesministerium für Bildung und Forschung