
Faculty of Engineering

Department of Agricultural Mechanization & Irrigation Engineering

Final Year Research Project

**GEOSPATIAL EVALUATION OF LAND SUITABILITY OF AGRICULTURAL
MECHANIZATION AND IRRIGATION IN AGAGO DISTRICT.**

A case study of Eastern Agago district

BY

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*A final year project Report Submitted to the Department of Agricultural Mechanization
& Irrigation Engineering in Partial Fulfilment of Requirements for the Award of a BSc. in
Agricultural Mechanization & Irrigation Engineering.*

ABSTRACT

Agricultural productivity in Uganda remains constrained by limited adoption of mechanization and irrigation, particularly in rural districts such as Agago. This study aimed to evaluate the land suitability for agricultural mechanization and irrigation in Agago District using geospatial analysis and multi-criteria decision-making techniques. High-resolution spatial data on topography, soil properties, land cover, water availability, and infrastructure were collected from authoritative sources, including the USGS, HWSD, MODIS, and UBOS. The study employed the Analytic Hierarchy Process (AHP) to assign weights to key factors influencing mechanization and irrigation potential. Using ArcGIS 10.8.2, individual suitability maps for mechanization and irrigation were developed and then integrated to create a combined land suitability model.

The results revealed that 13.31% of the district is highly suitable for both mechanization and irrigation, 76.26% is moderately suitable, 10.26% is marginally suitable, and only 0.17% is unsuitable. Validation of the model through laboratory analysis of soil pH and texture at selected ground-truth locations showed a high level of accuracy, with an R^2 of 0.92 and an 88% agreement rate between predicted and observed values. These findings underscore the reliability of geospatial modeling in guiding agricultural land-use planning and investment prioritization. The study concludes that Agago District holds significant potential for sustainable agricultural transformation through targeted mechanization and irrigation interventions. The generated suitability maps offer a critical decision-support tool for policymakers, extension officers, and development partners working toward climate-resilient agriculture in Northern Uganda.

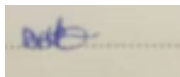
DECLARATION

I BASEKE BRIDGET PROSSY, hereby declare to the best of my knowledge, that this project report is an outcome of my original work and that it has not been presented to any institution of learning for an academic award.

Date

20th May, 2023

Signature



APPROVAL

This final year project report for the program of Agricultural Mechanization & Irrigation Engineering has been submitted to the Department of Agricultural Mechanization & Irrigation Engineering for examination with the approval from my supervisor.

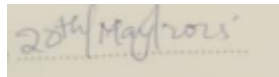
Supervisor

Eng. KUSEMERERWA JOSPEH

Signature



Date



DEDICATION

I dedicate this report to myself for the tireless efforts towards its accomplishment and family for the good support provided unto me since childhood, and for the spirit of hard work, courage and determination instilled into me, which attributes I have cherished with firmness and which have indeed made me what I am today, may God's blessings be upon them. Amen

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References

- Allen, R. G., Pereira, L. S., Raes, D., & Smith, M. (1998). *Crop evapotranspiration—Guidelines for computing crop water requirements* (FAO Irrigation and Drainage Paper 56). Rome: FAO.
- Brady, N. C., & Weil, R. R. (2008). *The Nature and Properties of Soils* (14th ed.). Pearson Education.
- Doorenbos, J., & Pruitt, W. O. (1977). *Crop Water Requirements*. FAO Irrigation and Drainage Paper 24. Rome: FAO.
- Eswaran, H., Lal, R., & Reich, P. F. (2003). Land degradation: An overview. In *Responses to Land Degradation* (pp. 20–35). CRC Press.
- FAO. (1976). *A framework for land evaluation*. FAO Soils Bulletin 32. Rome: FAO.
- FAO. (1985). *Guidelines: Land evaluation for irrigated agriculture*. FAO Soils Bulletin 55. Rome: FAO.
- FAO. (2003). *Land evaluation: Towards a revised framework*. Rome: FAO.
- FAO. (2007). *Land evaluation: A practical guide for land use planning*. Rome: FAO.
- Gebresenbet, G., Bosona, T., & Ljungberg, D. (2006). Supply chain and logistics in a local food supply network. *Biosystems Engineering*, 96(4), 495–505.
- Gowing, J. W., & Ejieji, C. J. (2001). Real-time scheduling of irrigation: Theory and practice. *Irrigation and Drainage*, 50(1), 59–69.
- Khan, S., Tariq, R., Yuanlai, C., & Blackwell, J. (2009). Can irrigation be sustainable? *Agricultural Water Management*, 96(3), 316–322.
- Lal, R. (2004). Soil carbon sequestration to mitigate climate change. *Geoderma*, 123(1–2), 1–22.
- Sys, C., Van Ranst, E., & Debaveye, J. (1993). *Land Evaluation: Part III - Crop Requirements*. Brussels: General Administration for Development Cooperation.
- Tadesse, T., Alemu, B., & Mengistu, K. (2017). Land suitability evaluation for rainfed crop production in Simada District, Ethiopia. *Cogent Food & Agriculture*, 3(1), 1327858.
-

- USDA-NRCS. (2008). *Soil Survey Manual*. United States Department of Agriculture – Natural Resources Conservation Service.
- Alemayehu, A., & Yadeta, A. (2024). Geospatial assessment of agricultural land for mechanization in Ethiopia. *Journal of Agricultural Engineering*.
- Ceballos-Silva, A., & López-Blanco, J. (2003). Evaluating land suitability for sustainable agriculture using AHP. *Geocarto International*, 18(2), 27–39.
- Diao, X., Silver, J., & Takeshima, H. (2016). Agricultural mechanization in Africa: Insights and implications. *IFPRI Discussion Paper*.
- FAO. (2003). *Guidelines for land evaluation for rainfed agriculture*. Rome: Food and Agriculture Organization.
- FAO. (2020). *State of Food and Agriculture 2020*. Rome: FAO.
- Foody, G. M. (2002). Status of land cover classification accuracy assessment. *Remote Sensing of Environment*, 80(1), 185–201.
- Haile, A. T., & Abebe, A. (2022). Land suitability analysis for surface irrigation using GIS and AHP. *Journal of Irrigation and Drainage Engineering*.
- Hussien, M., et al. (2019). Soil and water resource assessment for irrigation development in Ethiopia. *Water*, 11(9), 1826.
- Karimi, P., et al. (2021). Water availability and deficit analysis for irrigation using remote sensing. *Agricultural Water Management*, 255, 107037.
- Lal, R. (1990). *Soil erosion in the tropics: Principles and management*. McGraw-Hill.
- Malczewski, J. (2004). GIS-based land-use suitability analysis: A critical overview. *Progress in Planning*, 62(1), 3–65.
- MAAIF. (2023). *Annual Agricultural Sector Performance Report*. Ministry of Agriculture, Animal Industry and Fisheries, Uganda.
- Mendas, A., & Delali, A. (2012). Integration of GIS and AHP in land suitability assessment. *International Journal of Information Science*, 2(6), 67–74.
-

- NEMA. (2022). *Environmental Assessment of Agricultural Expansion in Northern Uganda*. Kampala: National Environment Management Authority.
- Pingali, P. (2007). Agricultural mechanization: Adoption patterns and economic impact. *Handbook of Agricultural Economics*, 3, 2779–2805.
- Saaty, T. L. (1977). A scaling method for priorities in hierarchical structures. *Journal of Mathematical Psychology*, 15(3), 234–281.
- Sims, B., & Kienzle, J. (2017). *Making mechanization accessible to smallholders*. Rome: FAO.
- Stehman, S. V. (1997). Selecting and interpreting measures of thematic classification accuracy. *Remote Sensing of Environment*, 62(1), 77–89.
- UBOS. (2022). *Statistical Abstract*. Uganda Bureau of Statistics.
- Worqlul, A. W., et al. (2017). Agricultural water management suitability using GIS and AHP. *Agricultural Water Management*, 180, 175–191.
- Brady, N. C., & Weil, R. R. (2008). *The Nature and Properties of Soils* (14th ed.). Pearson Education.
- FAO. (1985). *Guidelines: Land Evaluation for Irrigated Agriculture*. FAO Soils Bulletin 55. Rome: FAO.
- Jenny, H. (1994). *Factors of Soil Formation: A System of Quantitative Pedology*. Dover Publications.
- McBratney, A. B., Mendonça Santos, M. L., & Minasny, B. (2003). On digital soil mapping. *Geoderma*, 117(1–2), 3–52.
- USDA-NRCS. (2008). *Soil Survey Manual*. United States Department of Agriculture – Natural Resources Conservation Service.
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