Utilizing Open Source Geospatial Technologies to Map Communal Land Rights in Kenya.

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Key words: Communal Land Rights, Tenure Security, STDM, PostgreSQL, QGIS

SUMMARY

In Kenya, the Community Land Act of 2016 aims to recognize, safeguard, and register community land rights, ensuring effective management of communal lands. In drier regions of Bomet County in Kenya, community lands are facing degradation due to resource overuse and poor management. The research project in Bomet County, Kenya, aimed to map communal land rights using Open Source Geospatial Technologies. The research project involved a participatory mapping approach, involving local communities in gathering data on communal land boundaries and tenure arrangements.

Open-source geospatial technologies, such as satellite aerial photographs, QGIS, PostgreSQL, and the open-source land recordation tool STDM, were used to create parcel-based and up-to-date geo-databases of the communal lands. PostgreSQL was used for spatial database design and efficient storage, while QGIS provided spatial analysis tools and map production. STDM tool was used to customize, integrate, and document communal land rights in a standardized manner, identifying potential challenges and opportunities for land governance.

This research demonstrates the flexibility of pro-poor community land registration and the potential of open-source geospatial technologies for sustainable recordation of communal land rights as an alternative to the conventional method of community land registration, which has proven costly and time-consuming.

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1. INTRODUCTION

Only 10% of the 2.5 billion rural and indigenous people in Kenya have formally recognized rights to their lands, making them more vulnerable to dispossession by those with political, legal, and economic power. Population growth, climate change, and global demand for land and natural resources are putting pressure on land, with rural, nomadic, and forest-dwelling communities experiencing an influx of investors seeking land for logging, mining, infrastructure, and agribusiness ventures. (Knight et al., 2016) National elites and government agencies are claiming millions of hectares of land for investment ventures, mega-projects, and speculation. This can lead to environmental degradation, human rights violations, and other injustices. The urgent need for increased community land protection efforts is highlighted. The Community Land Act of 2016 enables the management and administration of community lands, but it leaves a large part of Kenya unmapped and communities vulnerable to dispute and confrontation. Chavangi et al. (2017)

2. OVERVIEW OF POLICIES GOVERNING COMMUNAL LAND TENURE IN KENYA

2.1 Communal Land Policy

Community land policy in Kenya aims to secure the tenure rights of peoples, recognizing their deep knowledge and connection to their lands. Studies show that indigenous peoples are better guardians of their communal lands than international or state protection agencies, challenging the idea of evicting peoples from their communal lands like forests for conservation purposes(Kenrick et al., 2023)

However, the Kenyan government and state agencies have been responsible for the severe depletion of indigenous lands(Claridge & Kobei, 2023). For example, the African Court of

Human and Peoples' Rights ruled in favor of the Ogiek, stating that the preservation of the Mau Forest cannot justify the denial of their rights and eviction from their land(Timmins et al., 2022). The court ordered the government to grant the Ogiek collective title of their lands(Onguny & Gillies, 2019).

Applying a private tenure system without considering cultural settings can fracture cultural and ecological coexistence between communities and the land . Community-based organizations can play a role in promoting collaboration and resolving land-related issues . Land conflicts in Kenya are influenced by the structure of politics and the relationships people have with land .

2.2 Acts Governing Communal Land Tenure in Kenya

The Land Registration Act (No.3 of 2012) is a procedural law that was passed to regulate land registration. The Act covers the registration of interests in all lands owned by the government, as specified by Article 62 of the Constitution; it also covers the registration and recording of interests in land held by communities (groups), as defined by Article 64 of the Constitution (Maina, 2014).

In accordance with section 8 of the Land Registration Act, 2012, the Act requires the maintenance of a communal land register. In accordance with section 8(7) of the Act, the Community Registrar initiates a community land registry in the name of the community and issues a certificate of ownership or lease upon receipt of the cadastral map. The Community Land Act of 2016 (No.27 of 2016) reinforces the ownership and use of land by community members, ensuring that collective ownership's benefits are shared fairly. (Wily, 2018)

3. THE NEED FOR OPEN-SOURCE TOOLS IN MAPPING COMMUNAL LAND RIGHTS

Open-source tools are crucial for mapping communal land rights, ensuring land tenure security, promoting sustainable development, and protecting local communities' rights. They are accessible and affordable, democratizing the mapping process.(Chipofya et al., 2021) They offer flexibility and community engagement in mapping communal land rights, allowing for customization and adaptation to diverse landscapes, cultural contexts, and legal frameworks, thereby fostering ownership and empowerment within local communities. Also,

they foster collaboration among stakeholders, promoting knowledge-sharing and problem-solving. They benefit from global community intelligence, ensuring continuous improvement and new features and provide mechanisms for communities to control land data, addressing concerns about data ownership, privacy, and potential exploitation. (Holland et al., 2022)

STDM is an open source tool, quicker, less beaureaucratic pro-poor approack that covers the uncoveredportion by recording all forms of land rights, social tenure relationships and overlapping claims (Augustinus, Lemmen, & van Oosterom, 2006). The STDM tool is a more flexible land information system that allows for the recordation of all possible types of tenure identified on the continuum of land rights rather than focus only on issuing individual leasehold of freehold titles.

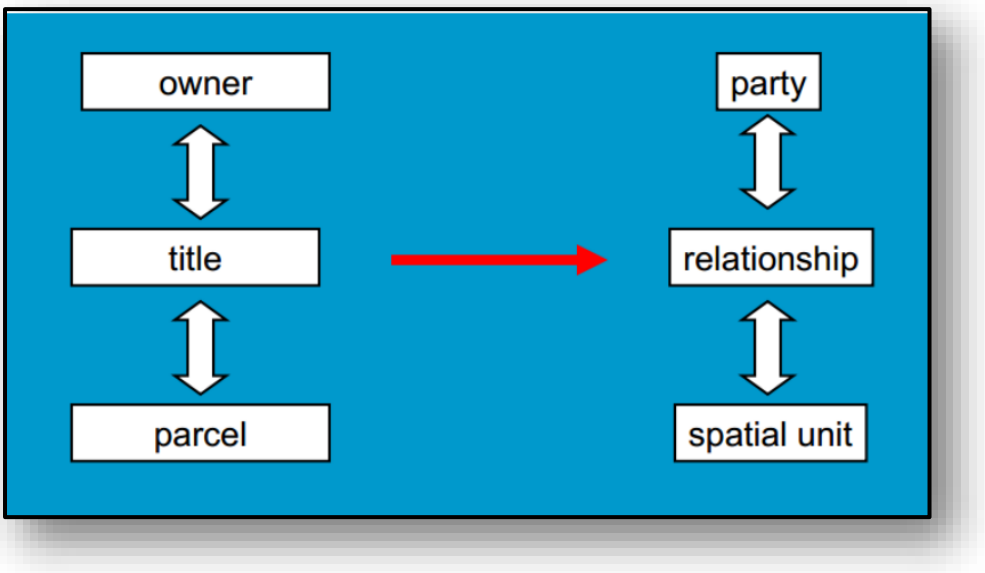


Figure 1: LADM Rights Concept (source: Kaufmann, 2004a)

4. METHODOLOGY

The case study method of research is employed. This approach is predicated on the idea that the case under investigation is typical of cases of a particular type. In light of this context, a single case study was chosen. Methods that combined quantitative and qualitative data were applied.

4.1 Area of Study

The case study examined two localities in Bomet County, Kenya, focusing on dairy farming and community lands. Sugumerga and Kembu wards, with different tenure arrangements for community land and natural resources, were chosen due to their pastoral setting. However, encroachment of these lands due to population growth and insufficient sustainable management are affecting their economic activities.

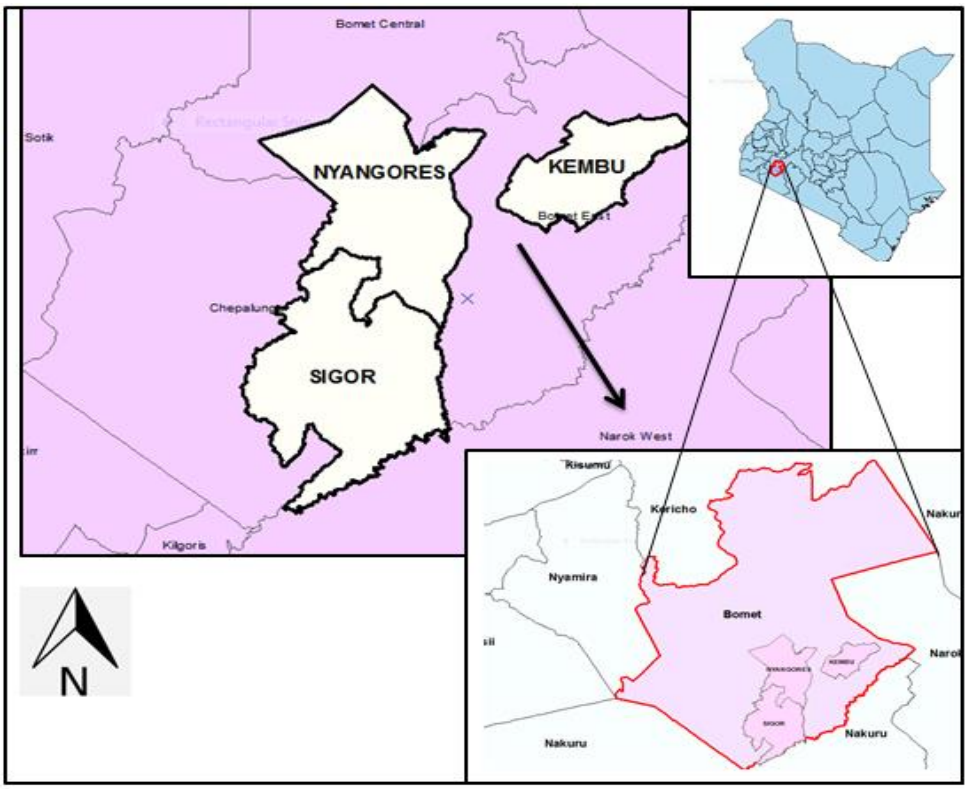


Figure 2. Area of Study in Bomet County in (Kenya)

Figure 3: Images showing some of the community lands facing encroachment in the area of study.

4.2 Research Tools

4.2.1 Primary Data Collection

The study utilized interviews and participatory enumeration to collect spatial and non-spatial data on communal lands, their usage, and management. Young people from the research region were trained in handheld GPS for mapping and processing, resulting in semi-structured interviews.

4.2.2 Data Analysis

Quantum GIS, an open-source desktop GIS program, was used as a mapping tool, and allowed viewing, manipulating, and analyzing spatial data. It is complemented by plugins like STDM, which can be integrated or distributed. QGIS is available in over 30 languages and is used by STDM for data editing and viewing.

4.2.3 Geo-Database Design

PostgreSQL tool was used in data manipulation and storage. The STDM import wizard was used to import all of the data collected during the participatory enumeration into PostgresSQL. In comparison to other open source databases, PostgreSQL has improved security features, stability, and data integrityand most operating systems support PostgreSQL. PostGIS was used to store geographical data, whereas PostgreSQL manages non-spatial relational data in STDM.

4.3 STDM Configuration and Data Import

The first step involved using QGIS to modify and visualize data. Fifty-three (53) community lands in Kembu and forty-three (43) community lands in Sugumerga were mapped using participatory mapping (participatory GIS). The community land shape files and an open-source image were edited using open-source QGIS. Spatial data was analysed and visualized in QGIS.

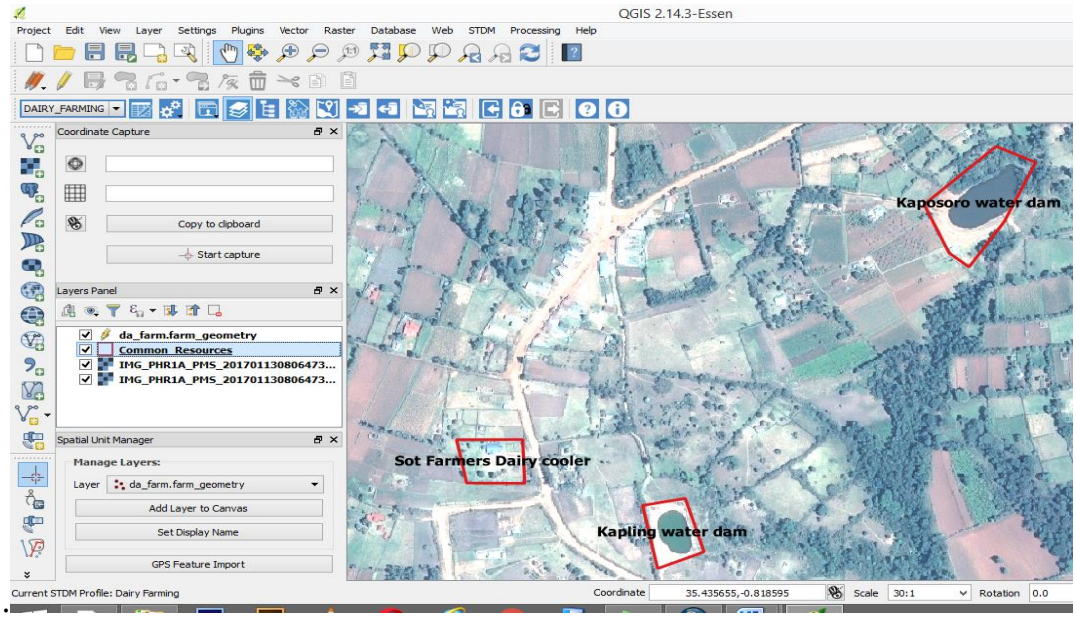


Figure 4: Community Lands overlaid on satellite imagery for visualization in QGIS

4.3.1 Data Configuration in STDM

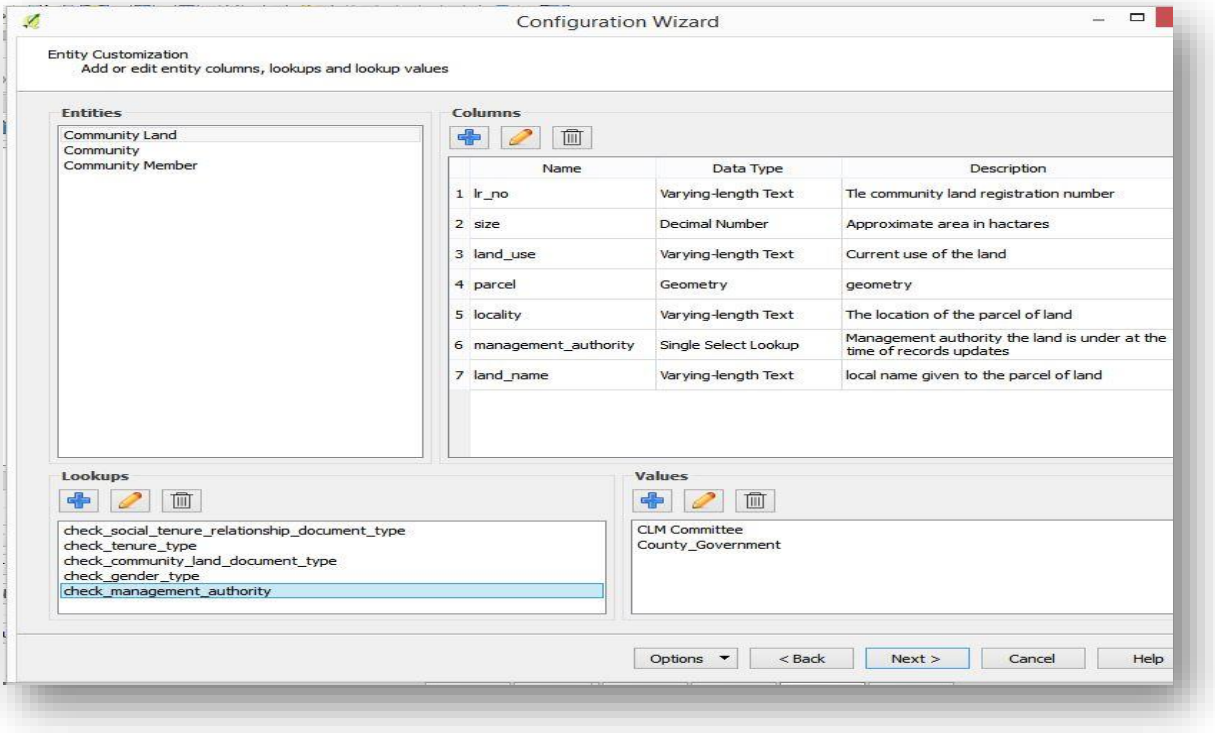


Figure 5: Creation of Entities and their respective Columns during data configuration

A profile of "Bomet Community Lands" was created for this study. Instead of investing in separate systems for each tenure type, the user could choose the database from among numerous available ones and combine different land tenure systems into a single system. When developing the data profile, the conceptual framework in the database architecture will be crucial. A profile is made up of the entities specified in the conceptual database. The attributes for the recognized entities are stored as columns or data fields for the tables, as shown in (Fig.5).

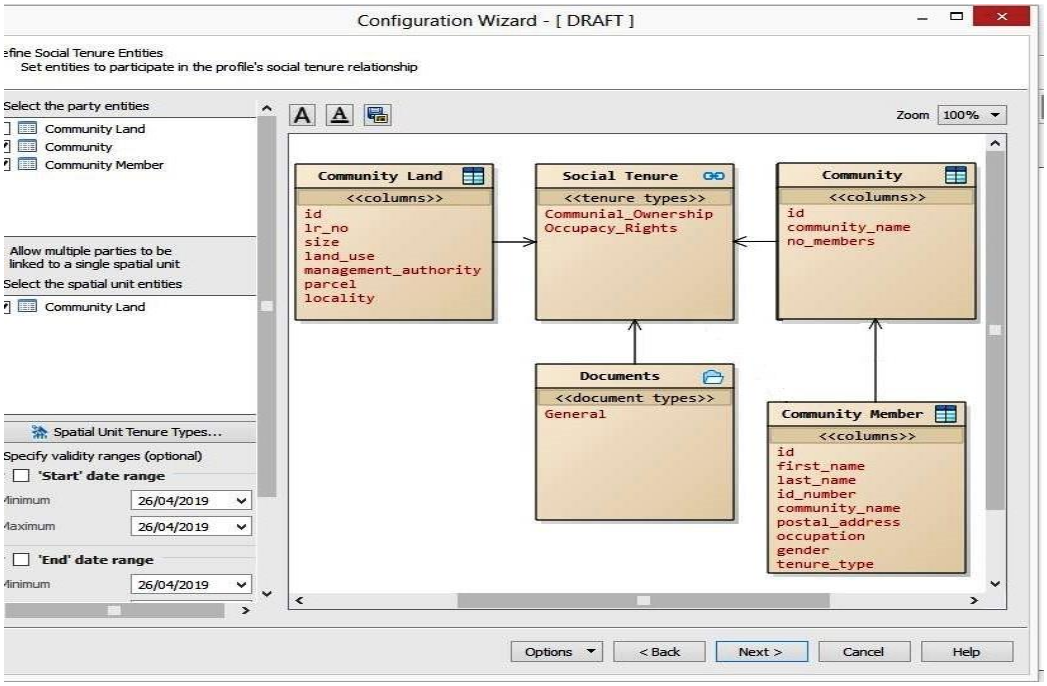


Figure 6: Database Schema in STDM

At this level of customization, additional profiles were added. Customization was done in reference to entities required in the Community Land Act and the conceptual model of the database design. The key entities captured were Community Lands, the registered community group, and the Community member trustee holding the land on behalf of the community. Figure 3.8 above shows the creation of the "Bomet County Land Register"

4.3.2 Spatial and Non Spatial Data Importation into STDM

The integration of both the spatial data and the attribute data into the STDM gives a complete database, hence making it possible to query. Non-spatial data on the common resources were first keyed in an Excel data sheet in a comma-delimited format before being imported into the STDM database. In the process of data importation into PostgreSQL, the schema is first built, and the source table attributes are matched with the destination table defined during the database configuration for a successful data importation.

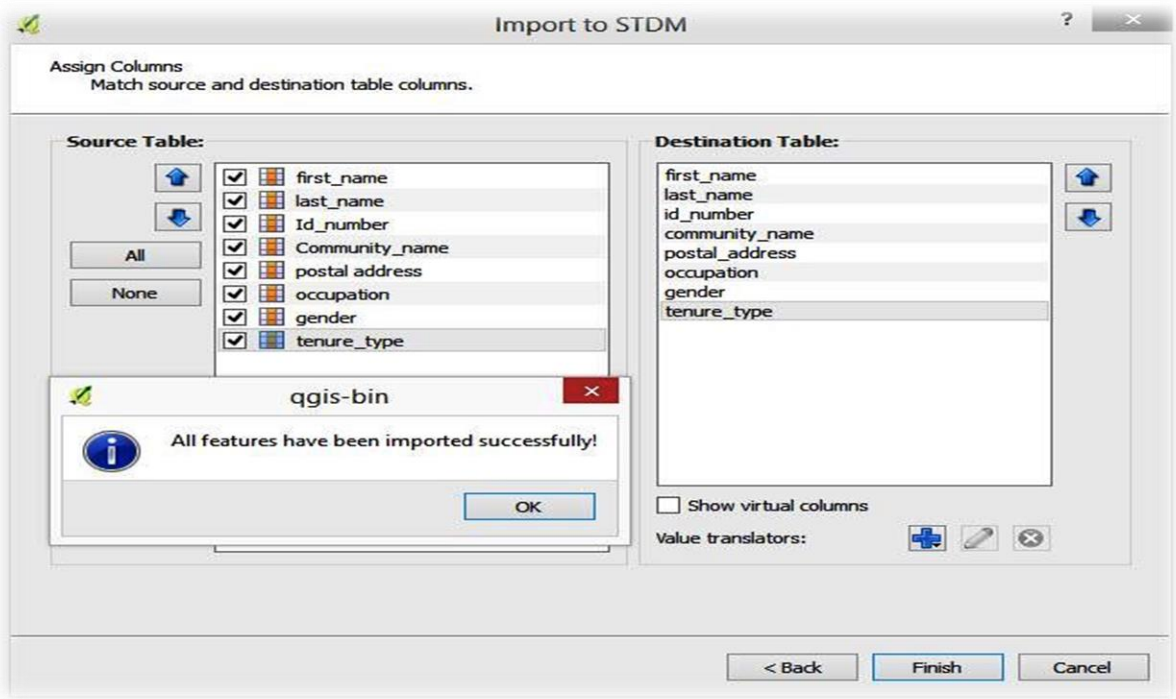


Figure 7: Importing Community trustee information into PosgreSQL

The source table attributes have to match with the destination table defined during the database configuration for a successful data importation.

4.4 Creating Social/Communal Tenure Relationships

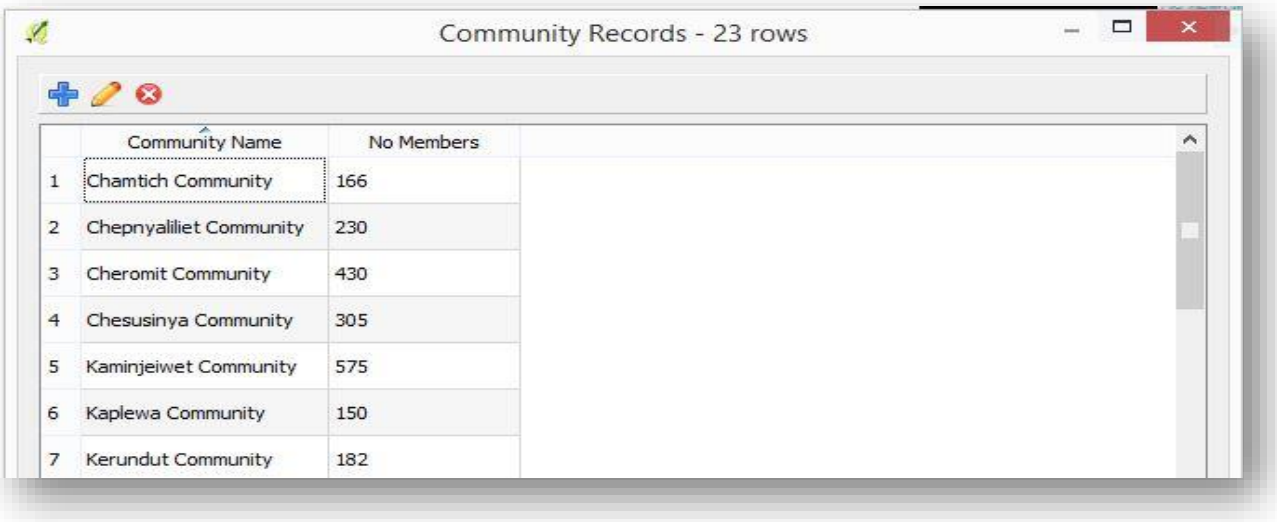
The social tenure relationship can be defined as the relationship between a party/person and a map of its content. This may be in the form of land or buildings on a map or any other property and its relationship with a person on the database. The search criteria may be by first name, last name, middle name, or ID number, depending on the user's knowledge of the Community trustee details. If multiple occupants share the name input, the user should use the other criteria to identify the target occupant. Once the occupant is identified, all the information about the person should appear below the search.

5. RESULTS

5.1 Community Land Register

A complete and up-to-date community land database was generated. Figure 8 displays registered communities, showing the number of community members in each community and

the register of all the community lands. Each community member is registered under a registered community name, as shown, and other information about the member's Name, Address, Occupation, Gender, ID No, and tenure type is attached to it.



	Community Name	No Members
1	Chamtich Community	166
2	Chepnyaliliet Community	230
3	Cheromit Community	430
4	Chesusinya Community	305
5	Kaminjeiwet Community	575
6	Kaplewa Community	150
7	Kerundut Community	182

Figure 8: A register showing registered communities and the number of members

Upon quarrying, the database shows a social tenure relationship between the community members and the available resources as shown in Fig 9.

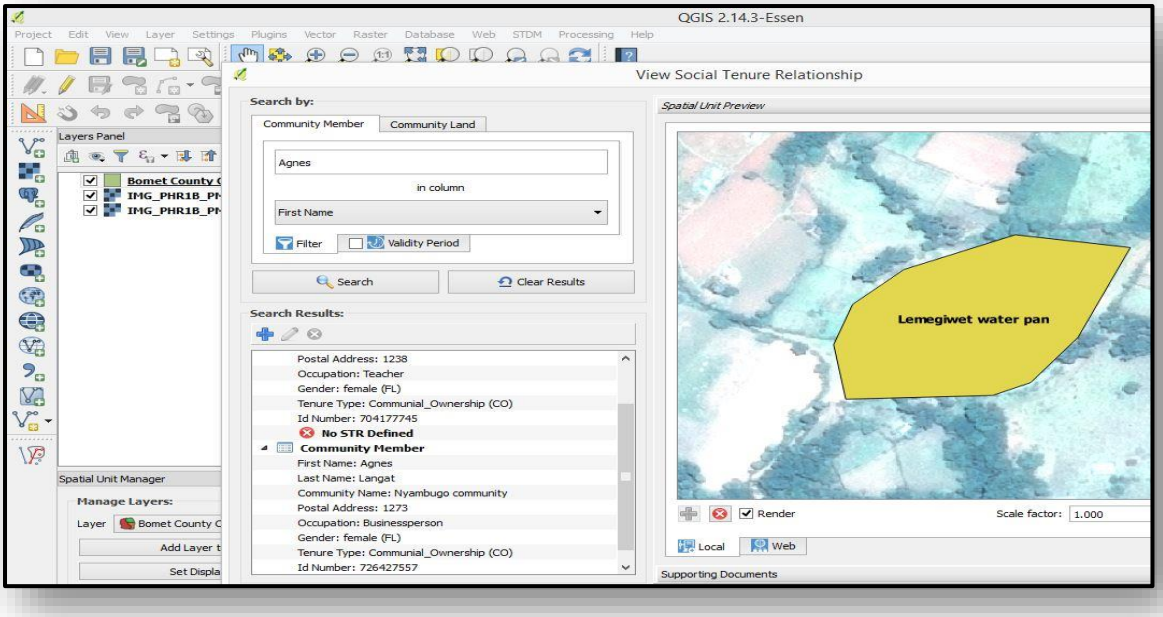


Figure 9: Viewing STR of a community land and a Community land trustee.

5.2 Community Land Map

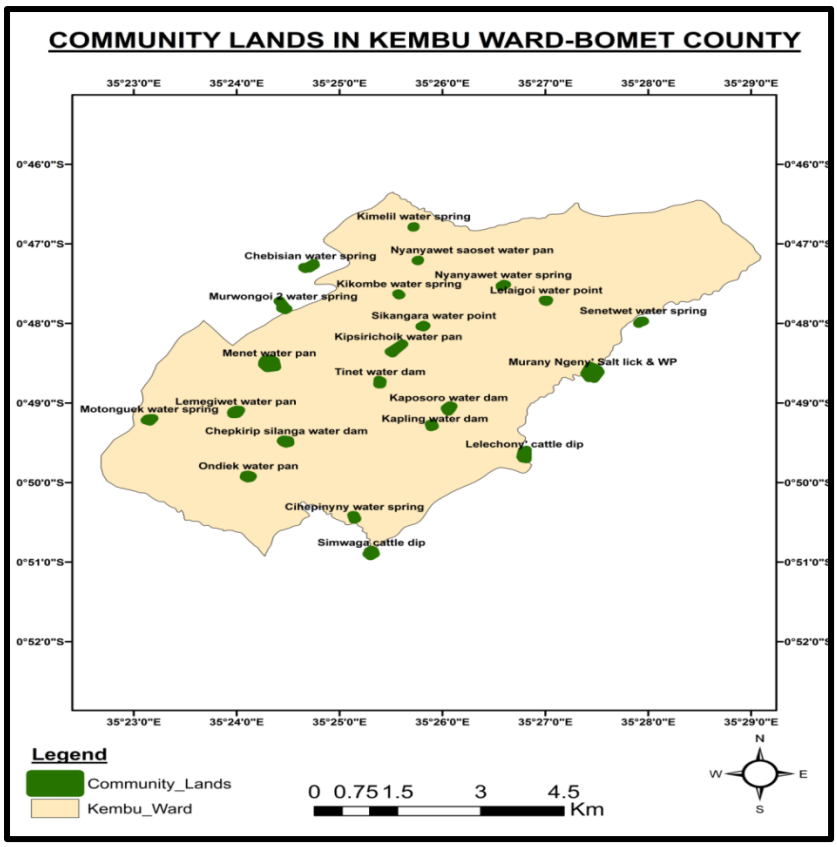


Figure 10: Community Land Map

A community land map was created using QGIS, including all 53 identified and mapped community lands. The Community needed to map these community lands since neighbouring parcels infringed upon them. Fifty-three community lands discovered and mapped in Kembu ward are shown on a map in Figure 10. Salt licks, shared grazing areas, dams, animal water points, water springs, cow dips, and water pans were some of the features of the community land.

5.3 Communal Land Data Retrieval and Dissemination

The system allows information retrieval by running a search on one of the community lands using its local name; Figure 11 and 12 displays a window with a Social Tenure relationship. The query outputs are shown in two columns; the spatial unit view on the right shows the community parcels, while the details of the community lands (Tinet Water Dam and Menet water pan) on the left show attributes such as the LR_No, Size, Land Use, Management authority, and tenure type/rights.

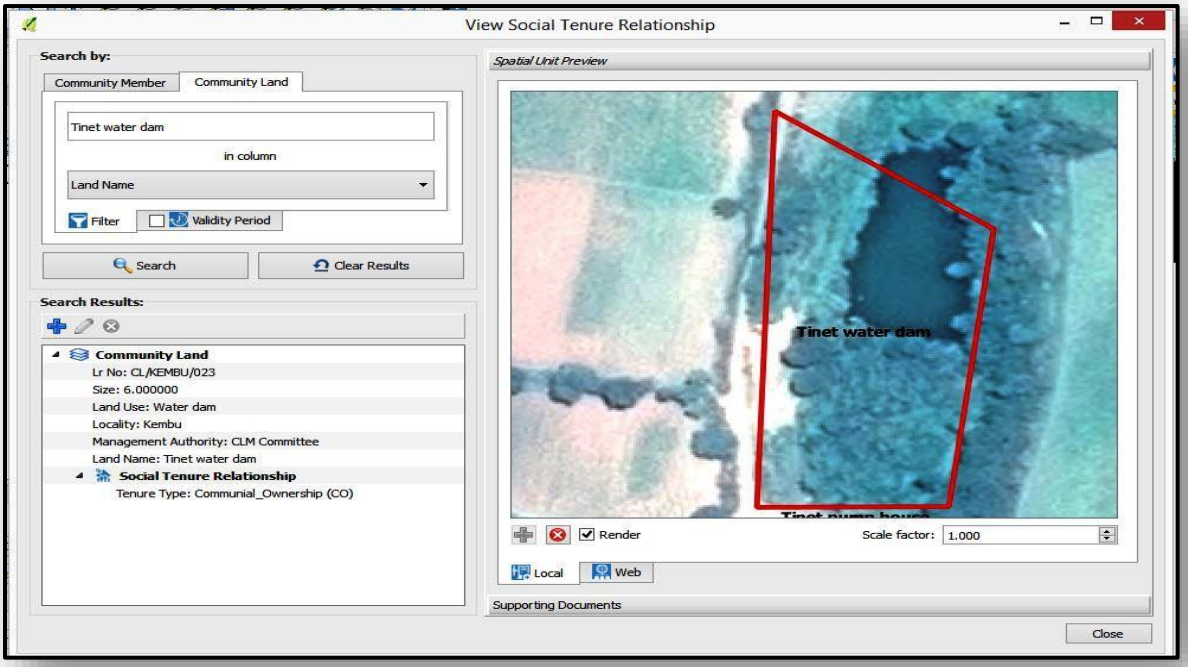


Figure 11: A spatial query showing nature of the Community Land; Tinet water dam

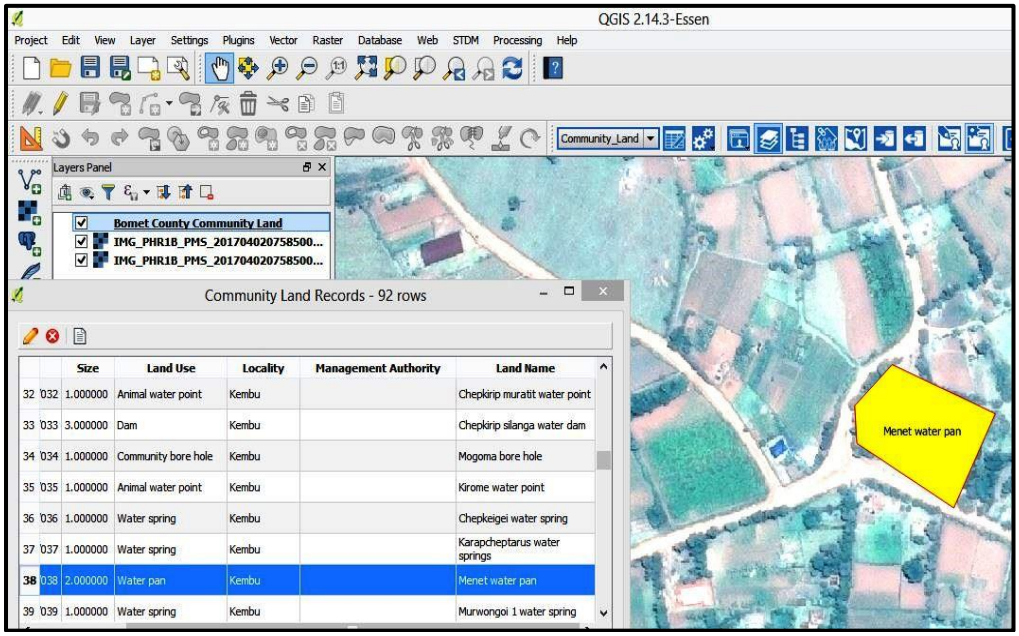


Figure 12: Spatial query showing Menet water pan

6. DISCUSSION

The Open-source geospatial tools offered numerous advantages for the community land recordation systems. These included accessibility, affordability, customization, community engagement, transparency, accountability, collaboration, rapid innovation, data ownership and privacy, adherence to open standards, capacity building, and sustainability. The process promoted inclusivity by involving community members and other stakeholders in mapping processes, fostering ownership and empowerment, and ensuring accurate land information, collective problem-solving, and knowledge exchange. Customization in STDM allowed for adaptation to diverse landscapes and legal frameworks, enhancing the community system's relevance across regions.

The process aided capacity building and sustainability, which are significant benefits. Through the community led mapping process, the information in the community register is more reliable for informed decision making.

7. CONCLUSION

The ongoing implementation of land reforms in Community Lands has provided an opportunity to test the open source tools so as to improve the procedures, updating records/registry, and registering common lands. The use of open-source tools in mapping communal land rights has proved to promote inclusivity, transparency, and sustainability. By empowering local communities and fostering collaboration, the open-source geospatial tools play a critical role in ensuring that land rights are accurately documented and respected.

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BIOGRAPHICAL NOTES

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Mr. Patrick Matata is a Tutorial Fellow, in the Department of Cadastre and Land Management, School of Survey and Geospatial Sciences at the Technical University of Kenya. He holds a Bachelor's degree in Land Administration from the Technical University of Kenya (2015), a Master's Degree in Geographic Information Systems from University of Nairobi (2019), and is currently doing his PhD in the area of "Modelling the Communal Land Tenure System in Kenya "in Kenyatta University. He is a Graduate Member of the Institution of Surveyors of Kenya (ISK).

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