frontiers | Frontiers in Human Dynamics

TYPE Original Research
PUBLISHED 19 October 2023
DOI 10.3389/fhumd.2023.1210065

Check for updates

OPEN ACCESS

EDITED BY
Amit Mitra,
Independent Researcher, New Delhi, India

REVIEWED BY
Felix Kwabena Donkor,
University of South Africa, South Africa
Shah Md Atiqul Haq,
Shahjalal University of Science and Technology, Bangladesh

*CORRESPONDENCE
Marya Hillesland
✉ marya.hillesland@qeh.ox.ac.uk

RECEIVED 21 April 2023
ACCEPTED 20 September 2023
PUBLISHED 19 October 2023

CITATION
Hillesland M, Doss CR, Mutua M, Guettou Djurfeldt N, Nchanji E, Twyman J and Korzenevica M (2023) Unbundling water and land rights in Kilifi County, Kenya: a gender perspective. *Front. Hum. Dyn.* 5:1210065. doi: 10.3389/fhumd.2023.1210065

COPYRIGHT
© 2023 Hillesland, Doss, Mutua, Guettou Djurfeldt, Nchanji, Twyman and Korzenevica. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

Unbundling water and land rights in Kilifi County, Kenya: a gender perspective

Marya Hillesland[1]*, Cheryl R. Doss[1], Mercy Mutua[2], Nadia Guettou Djurfeldt[2], Eileen Nchanji[2], Jennifer Twyman[3] and Marina Korzenevica[4]

[1]Oxford Department of International Development, University of Oxford, Oxford, United Kingdom, [2]Alliance Bioversity-CIAT, Nairobi, Kenya, [3]Aurelia Consulting, S.A.S., Cali, Colombia, [4]School of Geography and Environment, University of Oxford, Oxford, United Kingdom

Feminist scholars and activists have drawn attention to the importance of women's land rights, and studies focused on irrigation have explored the gendered relationships between land and water rights. Yet little of this work has focused on the relationship between land and water rights for domestic and productive purposes more broadly. Within rural communities, women and men have different rights to both land and water. We explore these interconnected relationships using community profiles, focus group discussions, and in-depth interviews from two communities as well as survey data collected from multiple adult members of rural households in Kilifi County, Kenya. Using a bundle of rights framework, we find that few individuals hold the complete bundle of rights over water, and the extent to which the rights are acknowledged by others and enforceable varies by the land-water tenure system. The full bundle of rights to water is most likely to be complete and most robust for men who have private water points on household land they hold. Even then, other people may assert claims to water at the water point, although these claims may involve negotiation or payment. Many water rights across the land-tenure systems are shared with others rather than being held by one individual. As such, the ability to negotiate water access is particularly important. The duration of the rights, or the length of time for which the rights are held, is embedded in social relations and exchange, particularly on others' household land. Women more than men seem to maintain a complicated set of social networks that allow them to negotiate for water from other women who manage the water transactions. The process of negotiation needs to be re-articulated each time. Thus, the duration of these rights to water depends on the ongoing relationships.

KEYWORDS

individual water and land rights, Kenya, legal pluralism, bundle of rights, land-water tenure system, gender, feminist approach

1. Introduction: feminist approaches to water and land rights

The rights to access and use of water are often related to rights over land. Women are much less likely than men to have secure rights to land, and yet, in many communities, they are the ones responsible for providing water to their households. In this paper, we use a feminist lens to explore the gendered relations of land and water rights. We map the complexity of land-water tenure structures in Kilifi County, Kenya—an area where rain-fed subsistence agriculture is predominant—and explore the mechanisms through which women and men have rights to water for domestic and productive purposes.

Drawing on a wide range of feminist analyses, particularly those in feminist economics (see Agenjo-Calderón and Gálvez-Muñoz (2019) for an overview) and inspired by critical feminist geographers (Sultana, 2021), we identify three key elements of a feminist approach relevant for this analysis. A feminist approach first insists that we understand individual rights that people hold, identifying how rights may be based on gender, household position, income and wealth, or other factors. It also recognizes that we cannot simply treat the household as the unit of analysis, but that we must also consider the rights and responsibilities of the individuals within the household. It involves collecting sex-disaggregated data that allow for analyses that go beyond the household and allows us to see every individual as worthy of study. At the same time, it also recognizes every individual is embedded in a web of social relations that shape their access to resources. These relationships are constantly negotiated and reflect dynamics of power among the people within a household and community (Adams et al., 1997; Sultana, 2011; Bukachi et al., 2021).

A feminist approach also may include multiple methods for data collection, bridging the quantitative and qualitative divides where appropriate (Berik, 1997; Nightingale, 2003; Behrman et al., 2014). In this paper, we use a mixed method approach to explore land-water tenure systems and how they relate to women's and men's rights and access to water. We use data from a quantitative household survey that was administered to multiple household members, both women and men, of different ages and positions within the household. We interviewed all available adults, not simply a man and woman identified as the principal couple. In addition, we incorporate qualitative data collected through key informant interviews, focus group discussions, and life history interviews in two communities for a richer description of these relationships.

Third, we join other feminists in giving value to understanding nuances of daily life (Dyck, 2005; Besio, 2006; Staeheli et al., 2012; Cole, 2017). These nuances may appear inconsequential because they do not fit within the power structures, or even researchers own preconceived notions of the relationships being studied. We seek to bring such attentiveness to the data to bring to light the complexities of the gendered nature of the nexus between land and water rights in Kilifi County, Kenya.

Land and water tenure is complex in Kenya. Land tenure systems can be broadly categorized as state ownership, common land, and private land ownership. State land is owned by the state government on behalf of the public. Common land is held by the county councils on behalf of the people. While some common lands, typically forests and rangelands, are held and managed collectively, many common lands are allocated to households for agricultural production and privately held under customary law. This land is often passed to family members through generations. Private land is owned by individuals under freehold and leasehold titles.[1] While there have been efforts to convert customary land held by households to freehold, most rural land held by households is held under customary law.[2]

Customary laws coexist with statutory law and impact how women and men access and hold land. Although customary laws vary across communities and ethnic groups in Kenya, men typically control much of the land and pass the rights to their sons. Women move to their husband's home when married and secure land use rights through their husbands. Statutory law appears to be more favorable to women than customary law, in that women have equal rights to land under statutory law. In the case of separation and the division of family property, the Matrimonial Property Act of 2013 states that women are entitled to a share of any property that was acquired during marriage. Additionally, Section 93(2) of the Land Registration Act of 2012, states: "A spouse may acquire an interest in his/her spouse's land if this spouse contributes by labor or other means to the productivity, upkeep and improvement of the land" [FAO Gender Land Rights Database (GLRD), 2023]. Statutory law also provides the right for daughters to inherit land from their parents. However, these more egalitarian laws are rarely followed, particularly for agricultural land and relatively few women are aware of their rights (Cotula, 2006; Djurfeldt, 2020). Those who do know about their rights face strong social norms discouraging them from exercising their legal rights (Djurfeldt, 2020). Thus, the potential promise of these formal laws is rarely fulfilled for women.

While the Constitution specifies that every person has the right to clean and safe drinking water and that resources, including water, belong to the people of Kenya, land tenure affects access to water. Under the Kenyan Water Act of 2016, the national government is the custodian of water resources, and individual and communities have usufruct rights obtainable through permits issued through the national-level Water Resource Authority (WRA). Registration is required for water use on common land held for the community by the county councils and on government land. In line with the previous Water Act, under the Water Act of 2016, individual registration of land vests in the titleholder not only "absolute ownership of the land" but also "rights appurtenant thereto" (i.e. rights belonging to the land) including water rights (Mumma, 2005; Gachenga, 2019). It also requires registration (Gachenga, 2019). While there is some legislative incongruity, individuals who hold land under customary tenure traditionally have unrestricted access to the surface and ground water on it for domestic uses (Shurie et al., 2017).

In addition to the coexistence of statutory law and customary norms, Bruns and Meinzen-Dick (2001) note other unwritten rules may bear upon who can access water on land from which sources and for which purpose. Various rules and norms shape land and water rights and the relationships between them. Thus, a broad understanding of land and water rights under systems of legal pluralism needs to go beyond what is typically granted through the statutory law and government regulations (Zwarteveen and Meinzen-Dick, 2001).

1 Leaseholds from the state can be acquired for up to 99 years (reduced from 999 years with the Constitution of 2010). Lands held as long-term leaseholds are considered a form of ownership and classified as private. See Boone et al. (2021) for discussion on land tenure in Kenya post-colonialism.

2 In this paper we use the term "household land" to refer to both private land (with freehold or leasehold titles) and for common land held and managed by households.

1.1. Conceptual framing of property rights and legal pluralism

It is useful to articulate what we mean by land and water rights. Although the characteristics of land rights may differ from water rights, we can think of them both broadly as property rights. It can be useful to disaggregate these rights and consider how specific rights may be held by different individuals, groups, or institutions. To understand women's property rights, Doss and Meinzen-Dick (2020, p. 3) draw on both Schlager and Ostrom (1992) and the Roman law system to identify six dimensions of rights that are relevant:

> "Usus: rights to use, including the rights of access and withdrawal
> Abusus: rights to change, including both management and transformation rights
> Fructus: rights to make profit and loss; economic owner
> Exclusion: rights to prevent others from using a resource
> Transfer: rights to transfer the property, whether temporarily or permanently
> Future interests: could include the right to inherit or other rights that can be realized at some future point."

Drawing on earlier work by Place et al. (1994) and Giovarelli and Richardson (2016), Doss and Meinzen-Dick (2020) note that to go beyond rights to understand women's tenure security of land, it is important to consider four dimensions:

> Completeness of the bundle of rights: Does the individual or group hold all of the rights or only some of them?
> Duration: What is the length of time for which the rights are held?
> Robustness: Are the rights acknowledged by others and enforceable?
> Individual or shared rights: Are the rights held by one individual or are they shared among spouses, family members, or communities?

As Doss and Meinzen-Dick (2020) explain, these dimensions are relevant for all of the types of land in Kenya. A similar set of rights and dimensions of secure tenure can also be applied to water. With water, the bundle of rights framework set out by Meinzen-Dick and Bakker (2001) divide *usus,* so that access in terms of swimming and non-consumptive water uses is separate from extraction, or the right to take or consume. *Fructus* rights are not included separately in the framework; instead, management includes the rights to benefit from the resource. While they are similar, we use the framework set out by Doss and Meinzen-Dick (2020) to structure our exploration of individual's rights to water, so that access for non-consumptive water uses and withdrawal are combined as *usus* rights, and the right to benefit or profit from the resource, *fructus* rights, is separate from the management of the resource.

This broader understanding of property rights and tenure security is also articulated by Ribot and Peluso (2003) who argue that the idea of access must go beyond a narrow definition of the right to benefit from things to an emphasis on the "the ability to derive benefits from things" (p. 153). Their approach recognizes that there are many different factors mediating property rights and tenure security.

1.2. Gendered land and water rights

Studies of gender and irrigation systems for agricultural production often consider the gendered relationships of land and water rights (Meinzen-Dick et al., 1997; Meinzen-Dick and Bakker, 1999; Von Benda-Beckmann and Von Benda-Beckmann, 2000; Meinzen-Dick, 2014). For example, Adams et al. (1997) describe a communal irrigation system in Marakwet, Kenya, where water rights are connected to the rights to the land and passed down through the lineage of the original builders. Women obtain usufructuary rights to the water through their husband or other male household members who hold the land and engage in the maintenance labor of the system (Adams et al., 1997). Similarly, in Nepal, Von Benda-Beckmann and Von Benda-Beckmann (2000) argue that it is through men's land rights that women have rights to the water. Because women become members of their husbands' family upon marriage and inheritance of land is patrilineal, women's rights to land, and thus their water rights to the irrigation systems through that land, is secured through her father-in-law or husband (Von Benda-Beckmann and Von Benda-Beckmann, 2000).

Beyond studies focused on irrigation, separate literatures focus on either women's land rights or on gender and water. Recognizing the importance of understanding the extent to which women hold and are able to claim land rights, a number of researchers have sought to document these rights. Most data available on landownership is collected at the household level and does not indicate who within the household is the owner. Increasingly, data is available on who within the household owns the land (Deere and León, 2003; Doss et al., 2015; Kieran et al., 2017; Agarwal et al., 2021). Some data is available on the broader bundle of rights and who within the household holds them. As an example, an analysis using data from six countries that disaggregates land rights by gender and identifies the reported owner, the documented owner, the manager, and the one holding *fructus* rights finds that these different rights often do not overlap; they may be held by different individuals within the household (Slavchevska et al., 2020).

Individual rights to land are shaped through different means. A person who has land that is titled or registered in their name or held under customary tenure, may have several rights within the bundle of rights to the land. But gender norms may mean that women owners do not hold the same bundle of rights as men owners. Quantitative evidence suggests that while women often report they own land jointly with their spouse, for example, they may not have the same rights to the land (Jacobs and Kes, 2015). A person who rents may have *usufruct* and *fructus* rights to the land, but not *transfer* rights. Others may have *usufruct* rights to family land through their familiar relationships, or to pastoral land through their community. The qualitative literature documents

how rights to land often are socially embedded within household relationships as well as relationships within the community. Women's land rights, in particular, are frequently mediated through their relationships (Ravnborg et al., 2016).

Similarly, rights to water points may be derived through a number of means. A person may have *usufruct* and *fructus* rights to a water point as a member of a local water users association and they may be stripped of this right, either temporarily or permanently, if they violate the rules of the organization (e.g. in Bukachi et al., 2021). As water becomes scarcer, formal and informal rules regarding the water point may change individual rights to the water. For example, in times of water scarcity, water from community dams may be limited to domestic purposes only, excluding *fructus* rights. As a member of the water committee, an individual also may have *abusus* rights to the water point. On private land, the rights to a water point may be based on who own's the land or provided labor inputs. Individual rights to water points that are open access may be determined by informal social rules and norms.

Rights to water at a water point may be restricted to a limited amount of water at a single point in time. People may purchase water from neighbors who have a tap, from vendors who sell water, or from a water utility company. Individuals may also acquire rights to water through non-cash transactions, such as providing labor or other goods in exchange for water. They may use their social networks to negotiate a jerrycan of water. Daily negotiations are central to securing small amounts of water particularly in insecure water areas (Sultana, 2011; Wutich et al., 2018b; Brewis et al., 2019; Bukachi et al., 2021; Joshi et al., 2022). At times, moral obligations drive water exchanges particularly in periods of water scarcity (Wutich and Ragsdale, 2008; Sultana, 2011). When a person does not have rights to water, water may also be appropriated. For example, Meinzen-Dick and Bakker (1999) note that women may take water from irrigation canals in Kirindi Oya, Sri Lanka, for home gardens, although formally prohibited.

All of these means to deriving rights to water are specific to the socio-ecological conditions, and defined within state institutions and overlapping and sometimes conflicting informal rules and norms within the communities (Roth et al., 2014). Individual rights are also embedded in social relations and are conditioned by gender. As an example, in her case study of the arsenic crisis in Dhaka, Sultana (2009) argues that women's access to public water is regulated by men's priorities, as men weigh access to safe drinking water against the cultural notion of what is gender appropriate for their wives and daughters as the main water collectors. Additionally, rules and norms around water are often defined and reproduced by social inequalities through class, caste, and other forms of social status (Nightingale, 2011). Despite that caste based discrimination is prohibited, dalit women in communities in India and Nepal, for example, cannot touch water and water sources as they are thought to contaminate the water (Nightingale, 2011; Johns, 2012; Joshi and Fawcett, 2022). In these cases, water access has to be negotiated in alternative ways.

Once water is brought to the home, members of the household have different claims on it, with women often managing the allocation across purposes. For example, in communities in Northern Ghana, women are expected to provide water to productive activities their husbands undertake (Jeil et al., 2020). In communities in Nampula, Mozambique, wives are expected to offer their husbands water to drink when he returns home as a welcome and provide water for his bath (Van Houweling, 2016).

Using the bundle of rights framework set out by Doss and Meinzen-Dick (2020), this paper expands on the land and water rights studies focused on irrigation to explore land and water rights more broadly. Specifically, it explores the land water tenure systems and women's and men's individual rights to water for domestic and productive purposes within these systems in Kilifi County, Kenya. The area has mixed land tenure systems and different types of water points, which provides an interesting opportunity to study the water rights across land water tenure systems. Beyond rights, we also consider the ability to access water sources and what factors may influence that ability.

2. Materials and methods

2.1. Study area

Kilifi County is on the coast just north of Mombasa City in Kenya. Extended families typically live together on a homestead with multiple dwellings. Sons' and nephews' homes are often situated alongside their father's or uncle's dwelling. Although recent registration efforts have increased the number of registered plots under statutory law, land held by the household is primarily customary land that was allocated by the local leaders and then bequeathed to sons and nephews. In addition to needing water for domestic purposes, water is brought to livestock and is used in some household enterprises. While many rural households depend on agriculture, crops are primarily rainfed. There is little irrigation in the villages.

The area has arid and semi-arid lands which are vulnerable to drought conditions, often resulting in people needing to travel long distances to collect water. Women and girls typically collect water for domestic and productive purposes from various water points and do so on foot by rolling the jerrycan with their feet, or by pulling it with a rope. When men collect water, they are more likely to do so on a motorbike or bicycle. This is largely due to social norms that designate water collection as women's responsibility but restrict women from riding bicycles or motorbikes.

2.2. Data collection

The data collection consisted of an intrahousehold survey and a set of qualitative approaches. The quantitative survey had two components: a household questionnaire and an individual questionnaire. The household-level questionnaire was first administered to the primary respondent, a household member who was well informed and made decisions about the household's water collection and use. In this questionnaire, the primary respondent was asked to list all water points in the community in the last year. For each water point listed, the primary respondent provided information on the type of water point (i.e. tap, borehole, or surface water) and the location, and identified who owns or holds rights

to the land the water point is located on. After administering the household-level questionnaire, each adult household member was interviewed privately. The individual-level questionnaire included detailed questions about their rights and access to all the water points listed by the primary respondent.

In addition, three qualitative approaches were used: key informant interviews, focus group discussions, and life history interviews. Key informant interviews with community leaders investigated social and economic aspects of each community, and the availability, access, management, and control of community water points. Focus group discussions were carried out separately to understand who is included and excluded from the different water points. Finally, in-depth life history interviews explored intrahousehold decision-making and norms in relation to water within households.

2.3. Sample selection

For the quantitative data collection, the research team used a stratified random sample, with oversampling of polygamous and extended family households. First, the team selected three sub-counties (Kaloleni, Magarini, and Ganze) that are predominately rural and have a greater prevalence of polygamous and extended family households than the other sub-counties. Within each of these sub-counties, two locations were randomly selected. Within each location, a listing of villages and households was conducted in August 2022. This involved first visiting the official offices at the sub-locations for a complete list of villages, which resulted in identifying 206 villages in the selected locations. Excluding the urban and peri-urban villages, 99 villages were randomly selected for the household listing, which involved calling each village leader of the selected villages and requesting a list of all the households. The team then traveled to the village to confirm the list of households by meeting with the village leader, checking the list with other village members, and through visual observation.

The survey was administered in October and November 2022. The survey sample was pre-established to include 700 households. From the 99 listed villages, 50 villages were randomly selected. Within these 50 villages, 350 households were randomly selected. For the other 350 households, the team oversampled households with co-wives and extended family households. To account for non-responses, replacement household lists were also created by random selection. The final sample includes 662 households.

Qualitative research was conducted in October 2022 in tandem with quantitative survey data collection. The team chose two sub-counties within Kilifi County—Margarini and Kaloleni—for qualitative data collection. One village from each of the selected sub-counties was selected based on the availability of the community elder, and the accessibility and availability of community members for the interviews and focus group discussions. The villages that were included in the quantitative survey were excluded to ensure that the qualitative interviews and discussions did not impact the quantitative survey data collection.

Once villages were selected, participants were recruited for the interviews and focus group discussions. The team worked to ensure the representation of various groups of individuals within the communities when recruiting research participants.

2.4. Sample composition

Within the quantitative sample, 66 percent of households live on a compound with two or more dwellings with an average of seven household members (Table 1). Within the 662 households, there are a total of 1,497 adults interviewed. Table 2 reports

TABLE 1 Household composition.

Proportion of households (or mean)	
Percent of households with co-wives	3.2%
Percent of households with three or more generations living together	21.6%
Percent of households consisting of extended family	34.0%
Mean number of household members	7.1 (0.156)
Percent of households living on a compound with two or more dwellings	66.0%
Number of observations	662

Standard deviation is in parentheses. Estimates incorporate survey weights to address oversampling of polygamous households and extended family households.

TABLE 2 Individual respondent descriptive statistics, composition of individual sample.

Proportion of individuals	
Share who are women	59.4%
Marital status	
Married, monogamous	57.6%
Married, polygamous	9.1%
Live together, not married	0.3%
Widowed	12.2%
Divorced or separated	6.6%
Single, never married	14.2%
Percent literate	58.9%
Religious affiliation	
Roman Catholic	3.9%
Protestant/other Christian	64.4%
Muslim	11.7%
Traditional religion	1.9%
No religion	18.2%
Share who are Giriama	91.6%
Highest level of educational attainment	
No primary	34.8%
Some primary	29.5%
Completed primary	20.2%
Secondary	12.8%
Post-secondary	2.7%
Number of observations	1,497

Estimates incorporate survey weights to address oversampling of polygamous households and extended family households.

TABLE 3 Summary of participants in qualitative research.

Panel A				
Technique		Magarini sub-county	Kaloleni sub-county	Total
Key informant interviews	Men	1	1	2
	Women	1	1	2
	Total	2	2	4
In-depth interviews	Men	4	4	8
	Women	4	4	8
	Total	8	8	16

Panel B							
Technique		Magarini sub-county		Kaloleni sub-county		Total	
		Number of groups	Number of participants	Number of groups	Number of participants	Number of groups	Number of participants
Focus group discussions	Young Men (18-35)	1	7	1	8	2	15
	Men (over 35)	1	6	1	8	2	14
	Total Men	2	13	2	16	4	29
	Young Women (18–35)	1	5	1	9	2	14
	Women (over 35)	1	9	1	9	2	18
	Total Women	2	14	2	18	4	32
	Grand Total (FGDs)	4	27	4	34	8	61

descriptive statistics for the full sample of individuals. About 60 percent of those interviewed are women.

Table 3 summarizes the participants in the qualitative data. In total, four key informant interviews were conducted to create the community profiles. The team also held in-depth life history interviews with 16 individuals, and a total of eight focus groups were convened.

2.5. Data analysis

The quantitative analysis relies on descriptive statistics to better understand general patterns in individual rights. To estimate the probability of women's and men's rights to different water points listed by the primary respondent, we use maximum likelihood models with village fixed effects (Tables available in Supplementary material). For all the statistical estimates, we use survey weights to address oversampling of polygamous and extended family households.

The qualitative data was analyzed using a thematic analysis approach following Clarke and Braun (2013). In general, we start by presenting the results from the quantitative data and then present related qualitative data. In practice, quantitative and qualitative data were analyzed simultaneously, and we used an iterative process to identify and conduct further analyses related to understanding gender differences in water rights across the land water tenure regimes.

3. Results

The unique data allows us to explore rights based on the lived experiences of various household members who know and use the water points in the local communities. We start by describing the water points in the communities and the different land-water tenure systems. We then explore women's and men's self-reported rights overall and across the land-water tenure systems. Finally, we examine differences between water rights and the ability to access water, specifically the constraints individuals face in accessing these water points.

3.1. Water points in the communities and their land-water tenure regimes

In the survey, each primary respondent was asked to list all the water points in the community and provide information regarding their household's access to each one, including any water points on their household's land. The most frequent sources listed and used by the household are tied to rights to land. They are tap water points sourced from boreholes and water from natural sources such as a stream, river, water pan, dam, or pond. In the analysis, we exclude rainwater catchments, retail shops, traveling vendors, and tanker trucks.

The full set of listed water points is thus 2,637 observations, each of which is a household's relationship with a specific water point. Each household may have a unique relationship with

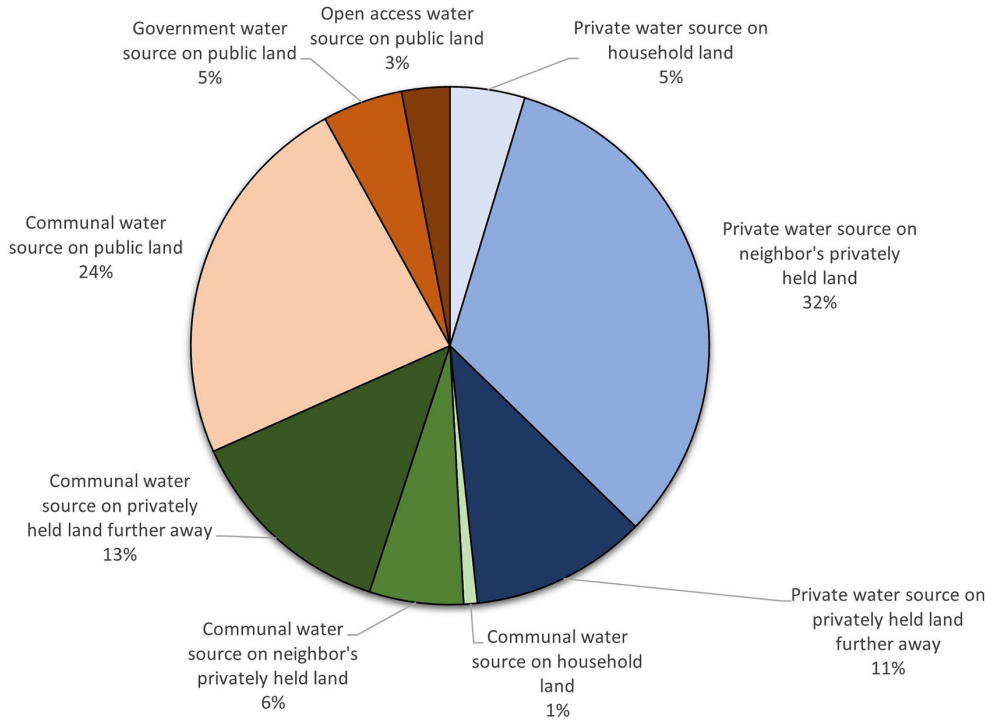

FIGURE 1
Land-water tenure regimes of water points in the community. These are the water points in the last year within the community listed by the primary respondent. These may or may not be water points the household used in the last four weeks. They exclude rainwater collection, retail shops, tanker trucks, and traveling venders. Based on 2,637observations. Estimates incorporate survey weights to address oversampling of polygamous households and extended family households.

the water point, depending on their specific rights to the land and the water and their ability to negotiate access. A particular water point will be reported as being on household land by a respondent in one household and on a neighbor's land by a respondent in a nearby household. Similarly, if one household has contributed labor to a water point on its neighbor's land and thus can access it freely, they may report it differently from those who must pay to use the water. Thus, each observation captures the experience of a particular household with each water point.

The water points can be categorized into five land-water tenure regimes (Figure 1). The first is private water points on household land. Household land is primarily land held by households through customary tenure; although, some of these plots are held through freehold agreements. The second is communal water points on household land. The third is communal water points on local or state government land. The fourth is utility run tap water points on local or state government land, and the fifth is surface water points on local or state government land without a designated manager.

Nearly half of the full set of listed water points, based on each household's relationship to the water points, are located on household land and are private water points. We distinguish between water points on the household's own land, on neighbor's plots, and on plots held by other households further away. Most listed water points that are on household land are on neighbor's plots. Only five percent of the listed water points are on the household's own land.

Household landholders may put in a tap, small dam, or well and have management rights and obligations over the water point.[3] The majority of private water points on household land are taps (78 percent). Individuals within the community can obtain water from these by negotiating with the landholder or his or her family member and paying a fee. Less than one percent of these transactions do not involve a fee. The qualitative data suggests that women often manage the water transactions, regardless of who within the household holds the land, but that men have control over the income earned. Correspondingly, the survey data suggests selling water from the tap is often seen as a joint household activity rather than women's own income activity even if women are managing the transactions at the water point.[4]

Twenty percent of the listed water points are communal and located on household held land (held by the household, a neighbor, or someone further away). Most (88 percent) of these are from surface water sources. They are primarily shallow wells or water pans where there may be initial digging and ongoing maintenance requirements for those to use it. These arrangements are often between neighbors, family, or friends. Neighbors who do not invest labor may be expected to pay for the use; for example, a young woman stated the following: "*Sometimes even before you dig up the*

3 Most of the tap water points on private land are sourced from nearby boreholes.

4 The sample of households who have water points on their land and sell water is small.

well, you might tell the neighbors to help in digging it up, however, [if they] decline and if they don't cooperate you will sell to them."

Nearly one-quarter of the listed water points are communal water points on public land. Public land includes both land held by the local community council and state land. Seventy-seven percent of these communal water points are in the form of a dam or other natural source. Only 19 percent are a tap.

Communally owned dams on public land are registered with the Water Resource Authority (WRA), and typically managed by water committees elected by community members. These water committees may work closely with local government officials such as the village chief. They oversee the maintenance of the dam and ensure the rules are followed. Households may be expected to send one individual to participate in maintenance duties; often these are set dates when the water point is widened, fenced, and/or desilted. There may be regular committee meetings to discuss challenges with the water point and decide the best way forward. Typically, those who follow the rules and participate in maintenance activities have access to the water without any fee. However, there may be limits on how they can use the water. In a key informant interview, one community leader explained that communal water dams are free to use but that community members do not have *fructus* rights over water: "*…if they find out you come with the motorbike to fetch the water and sell it as a business, there will be a problem.*" In addition, when water is scarce, the committee may charge a fee to limit use.

Five percent of the listed water points in the survey data are government-run tap and borehole water points on public land. As an example, the Malindi Water and Sewerage Company (MAWASCO) oversees the management of some boreholes in Kaloleni. They also pipe water from the boreholes to taps in different parts of the community. MAWASCO works with community leaders and representatives. Tap water points are available to all individuals in the community for a fee.

Three percent of the listed water points are natural sources on government land that are open access, meaning they are open to everyone in the community and lack a management group that governs the water point. In Kaloleni, the respondents describe a seasonal river that is a public resource not managed by anyone. It is not considered clean enough for drinking and cooking.

3.2. Rights to water points by land-water tenure regimes

We explore women's and men's rights to the listed water points and by land water tenure regime. For each listed water point, the survey asked each individual about their rights. To capture *usus* rights to the water point, the respondent was asked "Do you, yourself, have the right to use the water from the source for any purpose?" and whether they continue to have this right when water is scarce. These questions were translated as being allowed to or having the permission to extract water from the water point for at least one purpose, if they wanted. To capture *fructus* rights (rights to benefit from), the respondent was asked for which purposes the water from the water point could be used normally and when water is scarce, including any productive purposes. The productive purposes included the right to use the water for crops, livestock, or non-agricultural livelihood activities. It also included the right to sell the water. The right to *exclude* others from the water point, was captured by asking the respondent if they have the right to decide who can and cannot extract water from the water point. *Abusus* rights were captured by asking whether they have the right to make modifications to the infrastructure of the water point. This was translated as having decision making power to make changes.

Across the listed water points within these different land-water tenure regimes, nearly everyone reports he or she has *usus* rights or the right to access the water point and use the water for at least one purpose (Table 4 and Figure 2). When water from a water point cannot be used for multiple purposes, it typically can only be used for domestic purposes. When water is scarce, the likelihood of holding usus rights decreases, particularly for listed water points on others' household land (Figure 3). Individuals are less likely to have *fructus* rights, or the right to use the water for productive purposes, than to have *usus* rights across the land tenure systems, both generally and when water is scarce (Table 4 and Figures 3–5).

There are no major gender differences between *usus* and *fructus* rights. Women and men are equally likely to have *usus* and *fructus* rights on the listed water points across the land-tenure regimes with a few exceptions. One exception is that women are more likely than men to have *usus* rights on private water points on others' household land further away (six percentage points more likely) and when water is scarce (14 percentage points more likely). Women's stronger *usus* rights on others' household land further away may reflect the fact that women are more likely than men to manage household water including collecting the water for the household. When water is scarce, women may be able to strategically refer to their domestic responsibilities when negotiating with others to secure water.

Most of these water points on others' household land require payment, and the data suggests women are also more likely than men to have informal mechanisms for accessing water from other women without paying cash at the time of collection if they do not have the means to pay. When the water collector has a good relationship with the water point manager, she may be able to purchase water from the household on credit. A young woman explains: "*[S]ometimes you can plead with them, tell them, I do not have money today and I want water; I will pay you tomorrow.*" Water may be also exchanged for other goods such as firewood or poultry, or they may borrow water with the expectation the water is repaid with water on the following days. Men are less trusted to pay back and are excluded from water borrowing and credit, and women may not tell their husbands they are paying back for water purchased for fear they will disapprove. Indeed, men seem to be removed from some of these exchanges. When asked about water borrowing, older men in a focus group responded: "*We don't know, maybe it is a secret between the women.*"

Continued access to the water from the water point requires that the informal rules are followed. If they are not, these connections may be strained, and they may lose access to certain water points. Young women in a focus group explain that water is borrowed with the expectation that it is paid back as quickly as the day after. If it is not paid back it can result in a dispute: "*They will pester you till you return their water, you will have to plead with*

10.3389/fhumd.2023.1210065

TABLE 4 Women and men's individual rights to listed water points in their communities.

		(1)	(2)	(3)
Rights		Percentage of Women	Percentage of Men	Difference (1) – (2)
Usus	Do you, yourself, have the right to use the water from the source for at least one purpose?	96.8%	95.1%	1.6*
	When the water is scarce or not accessible from the source, do you still have the right to use the source for at least purpose?	82.8%	80.0%	2.8**
Fructus	Do you have the right to use the water point for productive purposes?	57.1%	56.1%	1.0
	Cropping	4.9%	7.5%	−2.6*
	Livestock	55.6%	55.0%	0.6
	Non-agricultural Income earning Activities	4.5%	4.3%	0.2
	When the water is scarce or not accessible from the source, do you still have the right to use the water point for productive purposes?	38.0%	37.0%	1.0
Exclusion	Do you have the right to decide who can and cannot use water from this source?	3.5%	3.5%	0.0
Abusus	Do you have the right to add or improve the infrastructure of the water point?	25.5%	30.5%	−5.1*
Number of rights held on water points	No rights	3.6%	5.1%	−1.5
	Usus and *Fructus* rights only	57.1%	56.1%	1.0
	Usus, *Fructus*, *Exclusion*, and *Abusus*	2.7%	3.2%	−0.5

Columns one, two and three are estimated from a maximum likelihood model taking into account village fixed effects and survey weights. Logit coefficients are in supplementary material. *indicates significance at 10 percent, **significance at 5 percent, and ***significance at 1 percent.

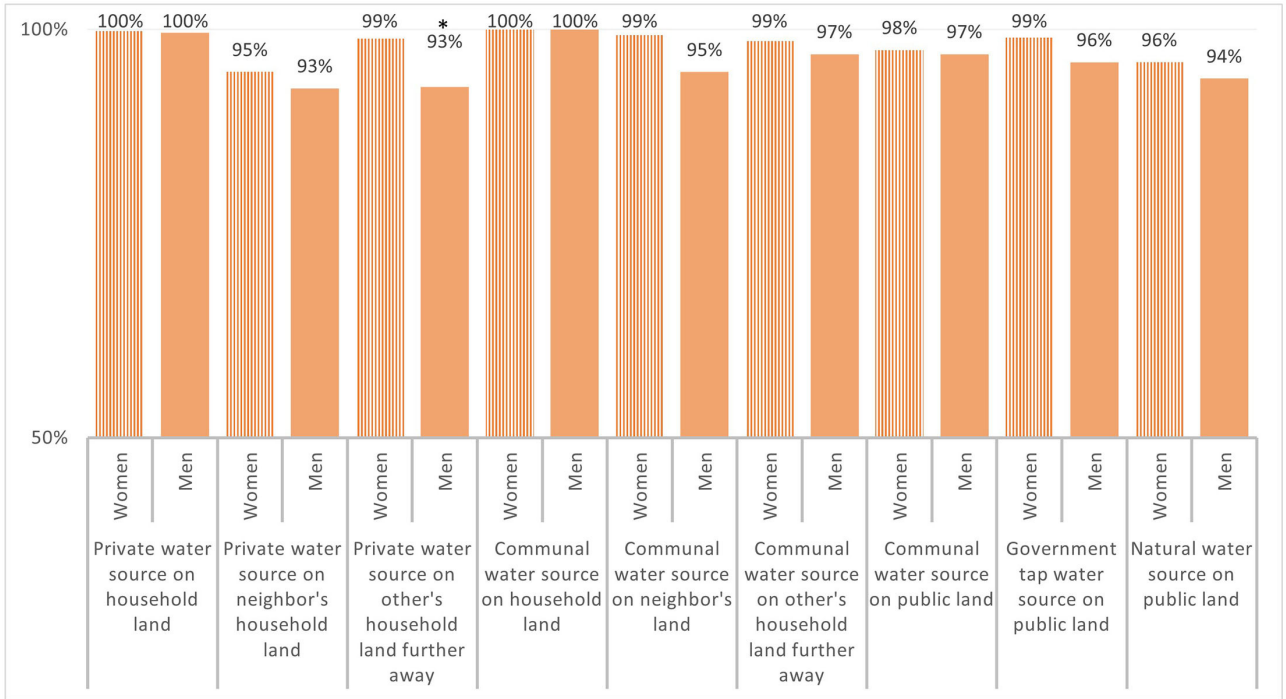

FIGURE 2
Women's and men's *usus* rights to listed water points, by land-water tenure system. These are predicted probabilities estimated from a maximum likelihood model taking into account village fixed effects and survey weights, with the exception of the estimates of the communal water source on household land. * indicates significance at 10 percent, ** significance at 5 percent, and *** significance at 1 percent.

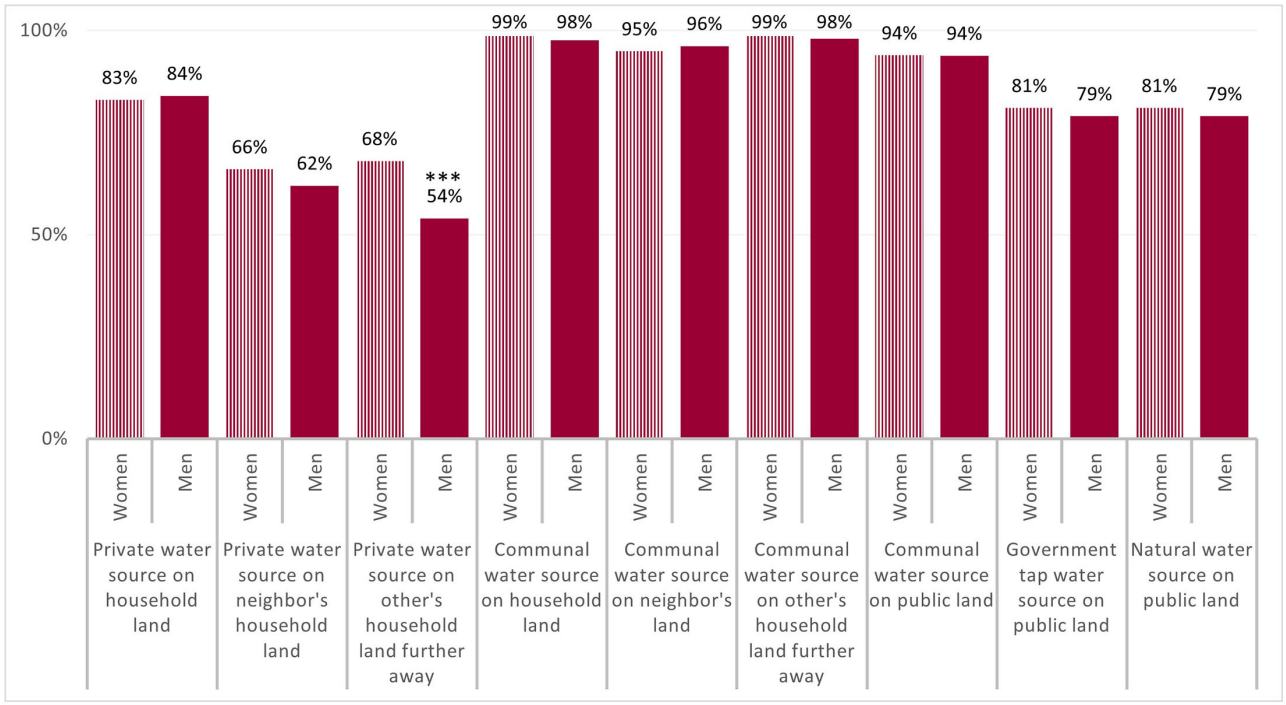

FIGURE 3
Women's and men's *usus* rights to listed water points when water is scarce, by land-water tenure system. These are predicted probabilities estimated from a maximum likelihood model taking into account village fixed effects and survey weights. * indicates significance at 10 percent, ** significance at 5 percent, and *** significance at 1 percent.

them to give you more time, sometimes they will fight." There are a number of listed water points (16 percent), primarily on neighbors' and others' household land, that the primary respondent says their household did not use in the last four weeks because of conflict, even though they report *usus* rights.

Once the water is collected, women who collect the water may not continue to have full *usus* or *fructus* rights to the water in the jerrycan. Many of the women who collect the water are also in charge of how to allocate the water in the household. But in allocating the water she must ensure that the water needs for livestock and other livelihood activities are met, even when these other activities are managed by someone else. As an example, while some larger livestock are taken to a water point, goats, which are often sold for cash or traded, typically have their water carried to them. Women are more likely than men to care for the animals including providing the water, but men are more likely to decide on the sale of the livestock and control the income earned. In the process of allocation, the water collector bestows the *fructus* rights of the water she collected to someone else.

Across the different land tenure systems, only three to four percent of individuals report they, themselves, have the right to *exclude* others from the listed water points (Table 4). This matches the share of households that have their own private water points. Indeed, most individuals are more likely to report this right on both private and communal water points on their own household's land than on listed water points in other land-water tenure regimes (Figure 6). However, for women, this is also based on their marital status. Widowed or divorced women are much less likely than married women to have the right to *exclude* others from using the water, suggesting women's right is interlinked to the water on land held with their spouse. When the relationship dissolves, the rights to the land, and thus the rights to the water on that land, become less secure.

Neither men nor women report they can prevent others from accessing the water on communal water sources on public land. While water committees with responsibilities over communal water points can *exclude* those who break the rules, it could be that it is not thought of as an individual right, and thus the survey question did not pick this up. While a committee can *exclude* individuals who break the rules, committee members themselves cannot individually decide to *exclude* users and, in fact, the qualitative data suggests the community collectively enforces rules as exemplified in the quote below.

> *The rules are followed by everyone, no one goes against them. If anyone goes against it, it's not only the chairman who will hold you accountable, the community will also do the same. The rules are protected by everyone*—Men's focus group discussion.

Overall, about 26 percent of women and 32 percent of men on the listed water points report they have some aspect of *abusus* rights, or the right to manage and make improvements to the water point (Table 4). Across many of the land tenure systems, men are more likely than women to have the right to improve or make

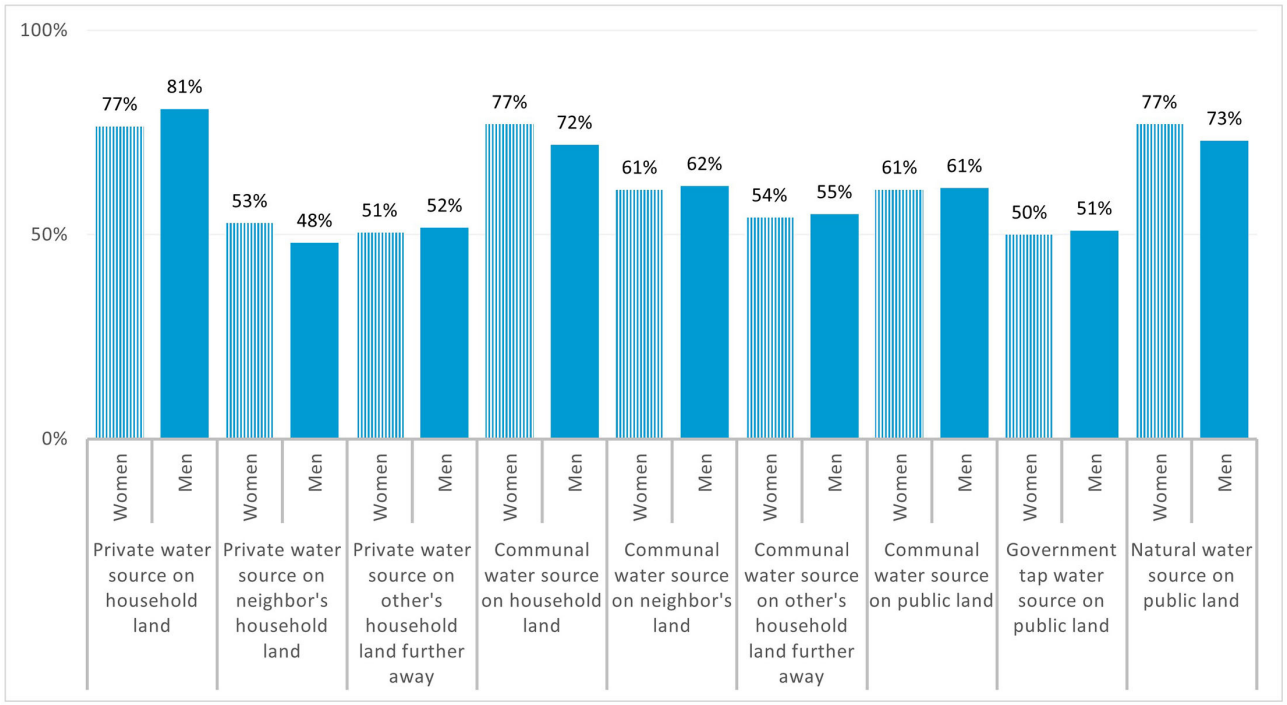

FIGURE 4
Women's and men's *fructus* rights to listed water points, by land-water tenure system. These are predicted probabilities estimated from a maximum likelihood model taking into account village fixed effects and survey weights. * indicates significance at 10 percent, ** significance at 5 percent, and *** significance at 1 percent.

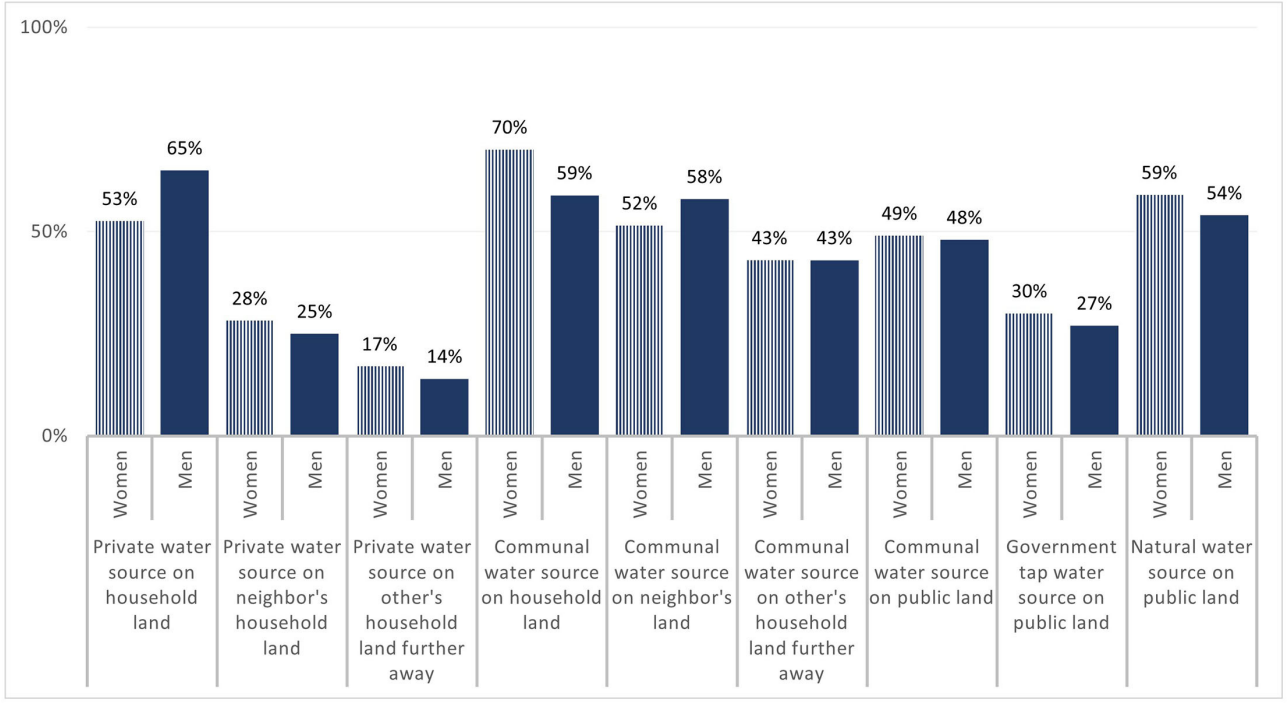

FIGURE 5
Women's and men's *fructus* rights to listed water points when water is scarce, by land-water tenure system. These are predicted probabilities estimated from a maximum likelihood model taking into account village fixed effects and survey weights. * indicates significance at 10 percent, ** significance at 5 percent, and *** significance at 1 percent.

10.3389/fhumd.2023.1210065

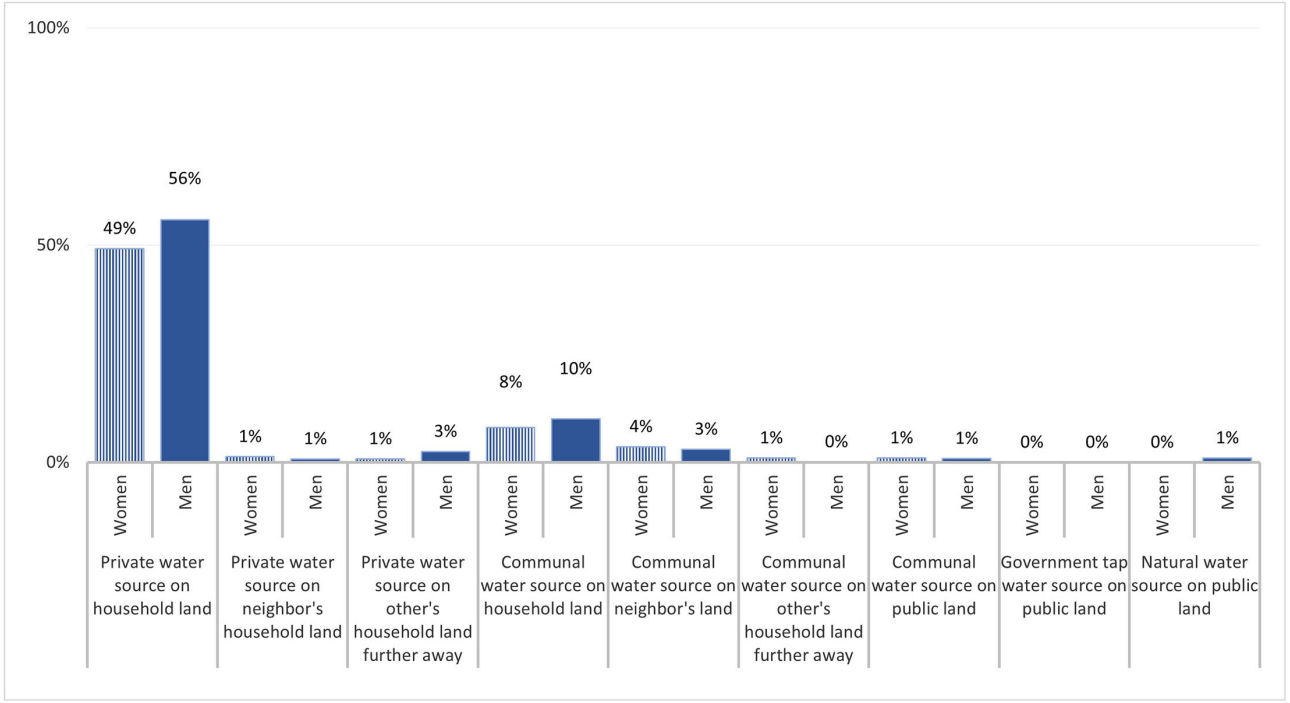

FIGURE 6
Women's and men's right to *exclude* on listed water points, by land-water tenure system. These are predicted probabilities estimated from a maximum likelihood model taking into account village fixed effects and survey weights. * indicates significance at 10 percent, ** significance at 5 percent, and *** significance at 1 percent.

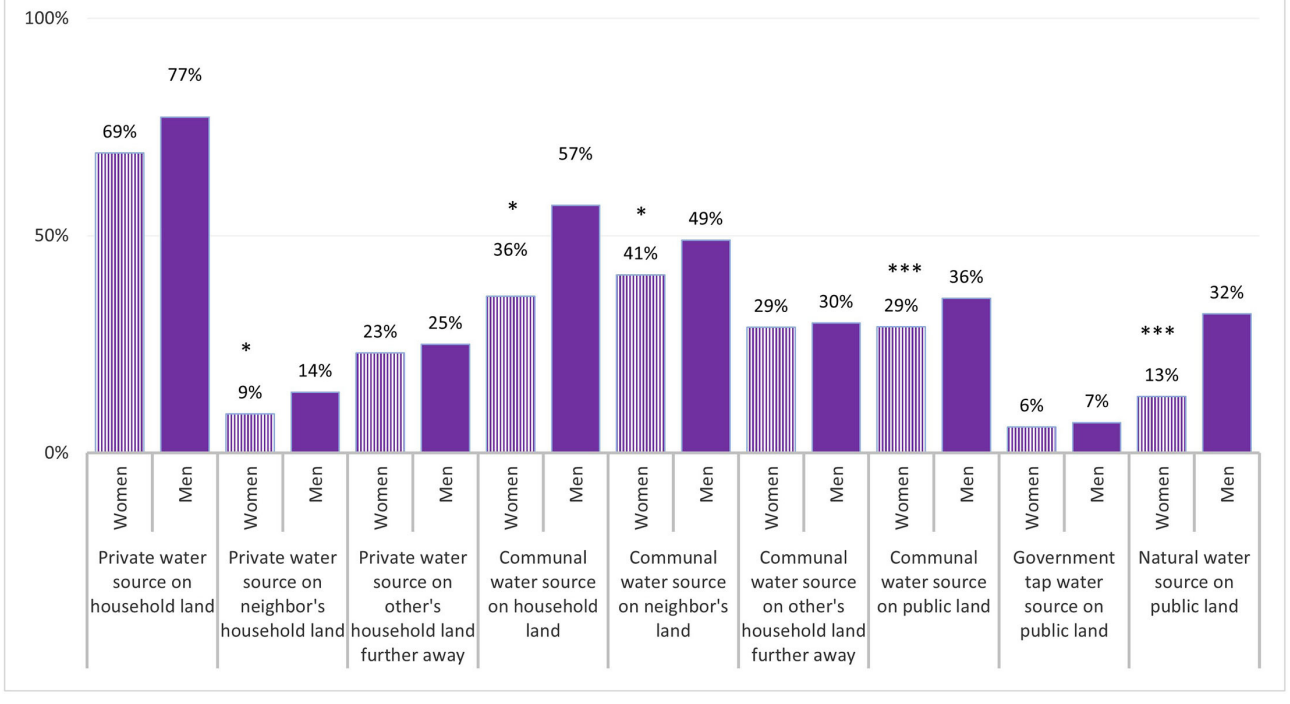

FIGURE 7
Women's and men's *abusus* rights on listed water points, by land-water tenure system. These are predicted probabilities estimated from a maximum likelihood model taking into account village fixed effects and survey weights. * indicates significance at 10 percent, ** significance at 5 percent, and *** significance at 1 percent.

changes to the infrastructure (Figure 7). On private water sources on their own household land and their neighbor's land, men's stronger rights to the land assigns them greater claim to decisions made about the water points' infrastructure on the land.

In common property systems, the associations of water users that govern and manage the water are typically men. Often there is an association of neighbors which govern and manage the water with the landholder, who would decide to make modifications to the water point. Similarly, communal water sources on government land, are typically managed and governed by water committees dominated by men and led by village leaders. While the water governance framework of WRA requires that at least 30 percent of the committee is represented by women, the qualitative data suggests while both women and men are represented, the committees are led by men. According to men in a focus group discussion, women do not lead the committees both because women prefer not to take the leadership role and because the community prefers men lead. Similarly, decisions to improve infrastructure on open access water points on government land need to go through government officials and village leaders, who are primarily men.

The survey did not specifically ask about *transfer* rights or *future interests*. As noted above, t*ransfer* rights of water points sourced by ground water on household held land are legally tied to the *transfer* rights of the land. While a large share of both women and men report they own land, women are much less likely to have the right to *transfer* the land. Nearly half of women report they own land, but only 14 percent report that they have the right to sell or bequeath land. In contrast, 63 percent of men in the sample are landowners and more than 40 percent have the right to sell and the right to bequeath the land. Men's stronger *transfer rights* to land than women, and the fact that surface and ground water rights are appurtenant to the land, mean men also have stronger *transfer* rights to water points on the land.

Because of customary norms, son's *future interests* are linked to the household's land. Sons are more likely to inherit household land from the father than daughters. Daughter's *future interests* in privately held *land*, which are more likely to be *usus* rights than inheritance, are linked with changes in marital status. On communal and government water points on public land, the younger generation as a whole has *future interests*. The water points and infrastructure *transfer* to the next generation to manage and use.

Across the listed water points, few individuals have all four rights reported in the survey (*Usus*, *Fructus*, *Exclusion*, and *Abusus*) (Table 4). Individuals are more likely to have a complete set of rights on private water sources on the own household's land than in other tenure systems, and men are more likely than women to hold a complete bundle of rights. This corresponds with the women and men who hold the land and claim ownership over the water points on the households' own land. The survey included a question on who owns the water points on the household land. Women are 42 percent less likely than men to claim ownership of the water point on the land, even when they claim ownership to the land. Men's stronger rights to the household's land appear to give men greater claim to the water points on the land than women.

3.3. Rights vs. ability to access

While nearly everyone reports the right to access water from most water points across the different water tenure systems, water scarcity, cost, distance, safety and lack of transportation can make some preferred water sources inaccessible even if the individual says he or she has the right to access the water source.

Water from different sources is not always available or accessible. In the dry season, many individuals have *usus* rights to a dry water point. Forty-two percent of these listed water points are rarely or seasonally available. The area is experiencing extreme drought conditions with lower-than-average rainfall for the past years. According to key informant interviews in Kaloleni, most of the water points on government land in the community, like dams, have dried up and many households rely on private tap options sourced by ground water or more distant public water points.

Tap water points (90 percent) are more likely to always or usually be available compared to natural sources (29 percent). Tap water points are closer to the homestead on average than free natural water points, and preferred for drinking and cooking as ground water is more likely to be safe to consume than surface water. However, *usus* and *fructus* rights to most of the tap water sources located on others' household land requires payment in cash or kind. Many cannot afford tap water or cannot completely rely on their networks for credit and borrowing for all their water needs.

> *….[P]eople who lack the means, and they are many, like that [disabled woman] who passed by here and I mentioned she goes all the way to Gotani to fetch dirty water. Only those that have the means fetch water from the taps.* - Woman, In-depth interview.

To find water, the free natural water points can be a far and strenuous walk from the homestead particularly with a 20-liter jerrycan of water. According to the survey data, collecting water from natural sources that are free takes 46 minutes on average to walk back (one way) from the source. In comparison, water taps tend to be a bit closer. It takes on average 27 min to walk back from the water tap one way. Additionally, many of the travel routes to the water point are physically demanding or nearly impassable (nearly 50 percent of the listed water points). Husbands may support the family members by paying motorcyclists to fetch water if they have the means, or husbands and sons may be involved in collecting water themselves. However, for many households, it is a physical burden heavily shouldered by women. On average a household made about 168 water collection trips over four weeks in September and October 2022 (or ∼42 trips a week on average). About two-thirds of these trips were made by women, and most trips were on foot (Table 5).

There are also concerns regarding physical safety when collecting water due to threats of harassment and violence for nine percent of the listed water points. The qualitative data suggests that because water collectors may need to walk to a water point far from the village and that there may be long queues, they may need to wake up before sunrise to go to the water source, line up their containers and wait for their turn to collect water. They may pass through sections of the community in the dark that are not safe.

TABLE 5 Water collection trips in the last four weeks in October and November 2022 in Kilifi County, Kenya on average per household.

		Mode of transport						
		Carry, kick, or pull jerrycan	Push wheelbarrow or cart	Mule, donkey or other animal	Bike	Motor	Other	Total
Men	Average number of trips in last four weeks	42	1	1	2	11	0	56
	Percent of total trips by men	25%	0%	0%	1%	7%	0%	33%
Women	Average number of trips in last four weeks	102	0	1	1	6	1	112
	Percent of total trips by women	61%	0%	1%	1%	4%	0%	67%
Total	Average number of trips in last four weeks	144	1	2	3	17	1	168
	Percent of total trips	86%	1%	1%	2%	10%	0%	100%

The primary respondent was asked to indicate who collected water at each water point listed (outside the household compound) and for each water collector to specify the typical number of trips in a day, week, and month to that source. The statistics take into account survey weights.

Both women and men are attacked, but those who are on foot are cited as the most vulnerable.

> *"There are so many challenges because like women are attacked on the way by the youths. They can leave here even at eight [in the morning] and still be attacked on the way. Recently one of them was attacked and was cut on the hand by the youth. At home, we might be waiting for water, but the mother was attacked on the way. There are many attacks around here. Because we don't have a motorbike or bicycle, the mother has gone to fetch [water] on foot and she was attacked on the way*—Men's focus group.

This general level of insecurity around safety particularly affects women and girls, because they are often responsible for collecting water. While they may have rights to the water, they may choose to steer clear of these water points if they can.

4. Discussion

When asked whether they have the right to access the various water points in the community, most respondents, both women and men, say they have *usus* rights to most of the water points. Yet, when asked more detailed questions, they reveal that these rights do not necessarily mean that they can always access water, or that the water point can be safely accessed. Like with other studies, rights vary by where the source of the water is located and the extent to which the person who is collecting the water can negotiate (Cherunya et al., 2015; Daly et al., 2021). Many water points are dry, especially during the current drought, and others are inaccessible due to impassable routes or for safety concerns. Water from taps is more reliable than natural water sources, and easier for water collectors to travel to, but *usus* rights to the tap water points requires payment, although the payment may be paid in kind or short-term credit may be extended. Water collectors, many who are women, in households that do not have their own water sources and cannot afford nearby taps on others' household land, often walk long distances to free natural water sources. Investment in local water infrastructure and roadways could improve access and reduce physical barriers.

At the same time, women are less likely than men to have the right to make decisions about changes to the infrastructure to the water points, which could potentially improve water availability and quality, and reduce the physical burden and time of water collection. This corresponds with wider literature on historical and structural exclusion of women from decision making and meaningful participation in water management, despite the critical responsibility of collecting the household's water (Coulter et al., 2019; Hannah et al., 2021). Addressing women's barriers to leadership positions could strengthen women's rights to the water.

When we consider the relationships among the four key dimensions of tenure security, we find differences in women's and men's water tenure security. First, in terms of *completeness*, few hold the complete bundle of rights for water. Only about five percent of the listed water points are private water sources on the household's own land. These plots tend to be held by men, and these men are among the few who hold the complete bundle of rights to the water sources. While the Land Registration Act of 2012 states wives have rights to the land through their labor contribution, this is not common knowledge and enforcement is limited (Djurfeldt, 2020). Studies suggest the pressure to privatize land in Kenya in the last thirty years has weakened women's land tenure security by registering the land in only their husband's names (Djurfeldt, 2020). This has implications not just for land tenure security, but also for women's water tenure security. Strengthening women's private land tenure and, thus, water tenure security, entails addressing the lack of awareness of rights to the land and making the formal land dispute resolution processes more accessible.

Second, the *duration of the rights*, or the length of time for which the rights are held, are embedded in social relations and exchange, particularly on household land. As found in other studies, water access often relies on the ability to benefit from social connections (Gomez-Temesio, 2016; Bukachi et al., 2021) and multiple forms of water sharing (Wutich et al., 2018a). Access to water on others' household land is not automatically granted through these relationships; it changes often and requires negotiation and renegotiation (Bukachi et al., 2021). While women are more likely than men to claim they can access water on others' household land, this seems to be because they maintain a complicated set of social networks that allow them to negotiate

water from women who control these water points. The process of negotiation needs to be re-articulated each time. Thus, the duration of these rights depends on the ongoing relationships. Similarly, rights to water on the household's own land depend on women's relationship to the landholder. Women's land rights are frequently mediated through those of their husband or other male relatives. As these relationships change, whether because she marries and moves to another household or because her marriage dissolves and she is pushed off the land, her rights to the water change.

Third, the *robustness* of the rights, or the extent to which the rights are acknowledged by others and enforceable, influence whether individuals can obtain water. The rights are most robust for men who have private water points on their household's own land. Rights to tap water on other household's land is most robust for those from wealthier households that always have the means to pay. For those who cannot pay for the water and instead negotiate an agreement, if there is breach in the agreement, access to the water point is lost until the relationship can be restored and the use can be renegotiated.

On communal water points that are managed by a water committee, the rights are often clearly spelled out. Yet, there is often room for negotiation in these contexts. The enforcement of the rights will depend on the relationships between those on the water committee and those seeking to collect water. The rights may be acknowledged by the community, but the committee may restrict people from using the sources if they have not met their obligations or have broken the rules.

Rights to government tap water sources are robust for those who can pay for the water. Natural water sources on public land tend to be open access without management. Enforcement of rights depends on informal mechanisms and shared local norms.

Fourth, many of these rights to water points are *shared* with others rather than being held by one individual. *Usus* and *fructus* rights to water points are shared with others either within the household, neighbors, or community depending on the land water system. The right to *exclude* and *abusus* rights are often shared with the spouse or other household members on water points on the household's own land. In some households, men have the individual right to *exclude* and *abusus* rights. On communal water points and natural water sources on public land, men are more likely to share *abusus* rights with other men than women in the community. Women are unlikely to have any of these rights individually. While some studies suggest that shared land property rights provide women less tenure security than individual land rights (for instance because household land in common tenure systems is often designated to men in the community or in some cases threats of violence from spouses or ex-spouses imply that women give up their shared rights to get out of bad relationships), it is unclear what the impact is for water since nearly all rights are shared to some degree with others. More research is needed to better understand how water rights are shared and the implications for water tenure security.

5. Conclusion

The study is unique in that it uses self-reported data of women's and men's water rights from multiple adults in households. Like other feminist studies, we also incorporate qualitative data, which provide a richer description of the land-water tenure systems in Kilifi County and how they relate to women's and men's self-reported rights to the water points. The qualitative data revealed the nuances and complexities within the relationships studied.

The study reveals there are many different factors mediating property rights and tenure security. While one may theoretically have the right to access or benefit, she may lack the means or ability to access. Simply identifying who holds the rights misses these other key dimensions about tenure security. For one, the challenge is not simply about the rights to water points, but about accessing clean water that is suitable for drinking. In the study area, tap water is sourced from nearby boreholes and tends to be cleaner than water from surface water sources. While almost everyone interviewed said they had *usus* rights to almost all of the listed water points, only individuals in households that had functioning water taps on their land or had the means to purchase water from nearby taps, had both the right and ability to access clean drinking water.

Additionally, it is not just the rights at the water point that matter. Women are typically responsible for collecting the water, but they also have obligations that they must meet in terms of how the water is allocated within the household. While they may have the right to allocate the water they collect, this can be a burdensome responsibility particularly when the amount of water that they can bring home is insufficient for the family's needs.

We also see that women and men are embedded in a web of social relations that shape their water rights and tenure security. In many contexts, women access land rights through their relationships with men (i.e. husbands, fathers, or other male relatives); in the case of water, we found that women's access to water is through multiple social relations, and perhaps most often through relationships with other women. It is rare that one person or group has the full bundle of rights over any given water point. Instead, many people may claim rights over it depending on its water land tenure system. The duration may be in perpetuity, or it may be that access is negotiated for a very short duration, such as for collection of water at one point in time. The robustness of the rights to water also varies by the water tenure system, but because almost all of the rights to water are held jointly with others, the ability to negotiate access is particularly important.

Finally, unlike land, water's unique properties make defining property rights to water more challenging. Water from streams may move across multiple types of land holdings, and changes in points upstream may reduce the downstream flow. Water points may be reliable only seasonally, or overtime completely dry up. Ground water may shift, or others may tap into the source from other landholdings, reducing the water available at a water point. Over time, the waterscape in Kilifi County, Kenya, will change and with it, the land-water tenure systems and women's and men's water tenure security.

Data availability statement

The raw data supporting the conclusions of this article will be made publicly available.

Ethics statement

The studies involving human participants were reviewed and approved by Central University Research Ethics Committee (CUREC) at the University of Oxford. Written informed consent for participation was not required for this study in accordance with national and institutional requirements. As there were limitations relating to literacy, the participants provided verbal informed consent which was then documented by the interviewers.

Author contributions

MH and CD contributed to the conceptualization of the paper. MH, JT, MM, and NG were involved in data/evidence collection. MH, MM, NG, and EN analyzed the data. All authors contributed to the writing and revision of the manuscript and approve the submitted version.

Funding

This work was supported by the REACH programme funded by UK Aid from the UK Foreign, Commonwealth and Development Office (FCDO) for the benefit of developing countries (Programme Code 201880), the Water Security and Sustainable Development Hub, which was funded by the UK Research and Innovation's Global Challenges Research Fund (GCRF) (Grant no.: ES/S008179/1), and the Measures for Advancing Gender Equality (MAGNET) initiative funded by the Bill and Melinda Gates Foundation (Code INV-005620).

Conflict of interest

JT is an independent consultant at Aurelia Consulting, S.A.S.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fhumd.2023.1210065/full#supplementary-material

References

Adams, W., Watson, E., and Mutiso, S. (1997). Water, rules and gender: water rights in an indigenous irrigation system, Marakwet, Kenya. *Dev. Change* 28, 707–730. doi: 10.1111/1467-7660.00061

Agarwal, B., Anthwal, P., and Mahesh, M. (2021). How many and which women own land in India? Inter-gender and intra-gender gaps. *J. Dev. Stud.* 57, 1807–1829. doi: 10.1080/00220388.2021.1887478

Agenjo-Calderón, A., and Gálvez-Muñoz, L. (2019). Feminist economics: theoretical and political dimensions. *Am. J. Econ. Sociol.* 78, 137–166. doi: 10.1111/ajes.12264

Behrman, J. A., Meinzen-Dick, R., and Quisumbing, A. R. (2014). Understanding gender and culture in agriculture: the role of qualitative and quantitative approaches. *Gend. Agricult. Clos. Know. Gap* 5, 31–53. doi: 10.1007/978-94-017-8616-4_2

Berik, G. (1997). The need for crossing the method boundaries in economics research. *Fem. Econ.* 3, 121–125. doi: 10.1080/135457097338735

Besio, K. (2006). Chutes and ladders: negotiating gender and privilege in a village in northern Pakistan. *ACME* 5, 258–278.

Boone, C., Lukalo, F., and Joireman, S. F. (2021). Promised land: settlement schemes in Kenya, 1962 to 2016. *Polit. Geogr.* 89, 102393. doi: 10.1016/j.polgeo.2021.102393

Brewis, A., Rosinger, A., Wutich, A., Adams, E., Cronk, L., Pearson, A., et al. (2019). Water sharing, reciprocity, and need: a comparative study of interhousehold water transfers in sub-Saharan Africa. *Econ. Anthropol.* 6, 208–221. doi: 10.1002/sea2.12143

Bruns, B. R., and Meinzen-Dick, R. S. (2001). Water rights and legal pluralism: four contexts for negotiation. Natural Resources Forum. *Wiley Online Lib.* 4, 1–10. doi: 10.1111/j.1477-8947.2001.tb00741.x

Bukachi, S. A., Omia, D. O., Musyoka, M. M., Wambua, F. M., and Peter, M. N. (2021). Exploring water access in rural Kenya: narratives of social capital, gender inequalities and household water security in Kitui county. *Water Int.* 9, 1–20. doi: 10.1080/02508060.2021.1940715

Cherunya, P. C., Janezic, C., and Leuchner, M. (2015). Sustainable supply of safe drinking water for underserved households in Kenya: investigating the viability of decentralized solutions. *Water* 7, 5437–5457. doi: 10.3390/w7105437

Clarke, V., and Braun, V. (2013). Successful qualitative research: a practical guide for beginners. *Success. Qualit. Res.* 25, 1–400.

Cole, S. (2017). Water worries: an intersectional feminist political ecology of tourism and water in Labuan Bajo, Indonesia. *Ann. Tourism Res.* 67, 14–24. doi: 10.1016/j.annals.2017.07.018

Cotula, L. (2006). *Gender and Law: Women's Rights in Agriculture*. No. 76. Roma: Food and Agriculture Origination of the United Nations.

Coulter, J. E., Witinok-Huber, R. A., Bruyere, B. L., and Dorothy Nyingi, W. (2019). Giving women a voice on decision-making about water: barriers and opportunities in Laikipia, Kenya. *Gend. Place Cult.* 26, 489–509. doi: 10.1080/0966369X.2018.1502163

Daly, S. W., Lowe, J., Hornsby, G. M., and Harris, A. R. (2021). Multiple water source use in low-and middle-income countries: a systematic review. *J. Water Health* 19, 370–392. doi: 10.2166/wh.2021.205

Deere, C. D., and León, M. (2003). The gender asset gap: land in Latin America. *World Dev.* 31, 925–947. doi: 10.1016/S0305-750X(03)00046-9

Djurfeldt, A. A. (2020). Gendered land rights, legal reform and social norms in the context of land fragmentation—A review of the literature for Kenya, Rwanda and Uganda. *Land Use Policy* 90, 104305. doi: 10.1016/j.landusepol.2019.104305

Doss, C., Kovarik, C., Peterman, A., Quisumbing, A., and Van Den Bold, M. (2015). Gender inequalities in ownership and control of land in Africa: myth and reality. *Agricult. Econ.* 46, 403–434. doi: 10.1111/agec.12171

Doss, C., and Meinzen-Dick, R. (2020). Land tenure security for women: a conceptual framework. *Land Use Policy* 99, 105080. doi: 10.1016/j.landusepol.2020.105080

Dyck, I. (2005). Feminist geography, the 'everyday', and local–global relations: hidden spaces of place-making*. *Can. Geograph.* 49, 233–243. doi: 10.1111/j.0008-3658.2005.00092.x

FAO Gender and Land Rights Database (GLRD) (2023). *FAO Gender and Land Rights Database*. Rome, Italy: Food and Agricultural Organization of the United Nations.

Gachenga, E. (2019). "Kenya's Water Act (2016): real devolution or simply the 'same script, different cast" in *Law | Environment | Africa*, eds P. Kameri-Mbote, A. Paterson, O. C. Ruppel, B. B. Orubebe, E. D. Kam Yogo (Nomos Verlagsgesellschaft), 429–452.

Giovarelli, R., and Richardson, A. (2016). *Land Tenure Security for Women: Threats and Effectiveness of Interventions. What Do We Know? Resource Equity, Friday Harbor*.

Gomez-Temesio, V. (2016). Home is claiming for rights: the moral economy of water provision in rural Senegal. *Soc. Nat. Resour.* 29, 654–667. doi: 10.1080/08941920.2016.1150535

Hannah, C., Giroux, S., Krell, N., Lopus, S., Mccann, L. E., Zimmer, A., et al. (2021). Has the vision of a gender quota rule been realized for community-based water management committees in Kenya? *World Dev.* 137, 105154. doi: 10.1016/j.worlddev.2020.105154

Jacobs, K., and Kes, A. (2015). The Ambiguity of joint asset ownership: cautionary tales From Uganda and South Africa. *Fem. Econ.* 21, 23–55. doi: 10.1080/13545701.2014.926559

Jeil, E. B., Abass, K., and Ganle, J. K. (2020). "We are free when water is available": gendered livelihood implications of sporadic water supply in Northern Ghana. *Local Environ.* 25, 320–335. doi: 10.1080/13549839.2020.1744118

Johns, H. (2012). *Stigmatization of Dalits in Access to Water and Sanitation in India*. It was submitted at the Human Rights Council in September.

Joshi, D., Haque, S., Nahar, K., Tania, S., Singh, J., and Wallace, T. (2022). "Public lives, private water: female ready-made garment factory workers in peri-urban Bangladesh," in *Water Security, Conflict and Cooperation in Peri-Urban South Asia: Flows Across Boundaries*, eds V. Narain, and D. Roth (Springer Nature), 67–88.

Joshi, D., Haque, S., Nahar, K., Tania, S., Singh, J., and Wallace, T. (2022). *Public Lives, Private* Water: *Female Ready-Made Garment Factory Workers in Peri-Urban Bangladesh*. Springer International Publishing. doi: 10.1007/978-3-030-79035-6_4

Kieran, C., Sproule, K., Quisumbing, A. R., and Doss, C. R. (2017). Gender gaps in landownership across and within households in four Asian countries. *Land Econ.* 93, 342–370. doi: 10.3368/le.93.2.342

Meinzen-Dick, R. (2014). Property rights and sustainable irrigation: a developing country perspective. *Agricult. Water Manag.* 145, 23–31. doi: 10.1016/j.agwat.2014.03.017

Meinzen-Dick, R., and Bakker, M. (1999). Irrigation systems as multiple-use commons: water use in Kirindi Oya, Sri Lanka. *Agric. Human Values* 16, 281–293. doi: 10.1023/A:1007507918459

Meinzen-Dick, R., and Bakker, M. (2001). Water rights and multiple water uses–framework and application to Kirindi Oya Irrigation System Sri Lanka. *Irrig. Drain. Sys.* 15, 129–148. doi: 10.1023/A:1012903127115

Meinzen-Dick, R. S., Brown, L. R., Feldstein, H. S., and Quisumbing, A. R. (1997). Gender, property rights, and natural resources. *World Dev.* 25, 1303–1315. doi: 10.1016/S0305-750X(97)00027-2

Mumma, A. (2005). *Presented at International workshop on 'African Water Laws: Plural Legislative Frameworks for Rural Water Management in Africa (Johannesburg)*. Available online at https://publications.iwmi.org/pdf/H038743.pdf (accessed January 28, 2023).

Nightingale, A. (2003). A feminist in the forest: situated knowledges and mixing methods in natural resource management. *ACME Int. J. Crit. Geograph.* 2, 77–90.

Nightingale, A. J. (2011). Bounding difference: intersectionality and the material production of gender, caste, class and environment in Nepal. *Geoforum* 42, 153–162. doi: 10.1016/j.geoforum.2010.03.004

Place, F., Roth, M., and Hazell, P. (1994). Land tenure security and agricultural performance in Africa: overview of research methodology. *Search. Land Tenure Sec. Africa* 5, 15–39.

Ravnborg, H. M., Spichiger, R., Broegaard, R. B., and Pedersen, R. H. (2016). Land governance, gender equality and development: past achievements and remaining challenges. *J. Int. Dev.* 28, 412–427. doi: 10.1002/jid.3215

Ribot, J. C., and Peluso, N. L. (2003). A theory of access. *Rural Sociol.* 68, 153–181. doi: 10.1111/j.1549-0831.2003.tb00133.x

Roth, D., Zwarteveen, M., Joy, K. J., and Kulkarni, S. (2014). Water rights, conflicts, and justice in South Asia. *Local Environ.* 19, 947–953. doi: 10.1080/13549839.2012.752232

Schlager, E., and Ostrom, E. (1992). Property-rights regimes and natural resources: a conceptual analysis. *Land Econ.* 9, 249–262. doi: 10.2307/3146375

Shurie, M. M., Mwaniki, B., and Kameri-Mbote, P. (2017). *Water Permit Systems, Policy Reforms and Implications For Equity in Kenya*. Project Country Report. Output from the REACH programme.

Slavchevska, V., Doss, C. R., De La, O., Campos, A. P., and Brunelli, C. (2020). Beyond ownership: women's and men's land rights in Sub-Saharan Africa. *Oxford Develop. Stud.* 5, 1-21. doi: 10.1080/13600818.2020.1818714

Staeheli, L. A., Ehrkamp, P., Leitner, H., and Nagel, C. R. (2012). Dreaming the ordinary: daily life and the complex geographies of citizenship. *Prog. Hum. Geogr.* 36, 628–644. doi: 10.1177/0309132511435001

Sultana, F. (2009). Fluid lives: subjectivities, gender and water in rural Bangladesh. *Gend. Place Cult.* 16, 427–444. doi: 10.1080/09663690903003942

Sultana, F. (2011). Suffering for water, suffering from water: emotional geographies of resource access, control and conflict. *Geoforum* 42, 163–172. doi: 10.1016/j.geoforum.2010.12.002

Sultana, F. (2021). Political ecology 1: from margins to center. *Prog. Hum. Geogr.* 45, 156–165. doi: 10.1177/0309132520936751

Van Houweling, E. (2016). "A good wife brings her husband bath water": gender roles and water practices in Nampula, Mozambique. *Soc. Nat. Resour.* 29, 1065–1078. doi: 10.1080/08941920.2015.1095377

von Benda-Beckmann, F., and von Benda-Beckmann, K. (2000). "Gender and the multiple contingencies of water rights in Nepal," in *Water, Land and Law: Changing Rights to Land and Water in Nepal; Proceedings of a Workshop Held in Kathmandu*, 18-20 March 1998, eds R. Pradhan, F. von Benda-Beckmann, and K. von Benda-Beckmann (Kathmandu: Legal Research and Development Forum), 17–38.

Wutich, A., Budds, J., Jepson, W., Harris, L. M., Adams, E., Brewis, A., et al. (2018a). Household water sharing: a review of water gifts, exchanges, and transfers across cultures. *Wiley Interdiscip. Rev. Water* 5, e1309. doi: 10.1002/wat2.1309

Wutich, A., Budds, J., Jepson, W., Harris, L. M., Adams, E., Brewis, A., et al. (2018b). Household water sharing: a review of water gifts, exchanges, and transfers across cultures *Wiley Interdiscip. Rev. Water* 5, e1309.

Wutich, A., and Ragsdale, K. (2008). Water insecurity and emotional distress: coping with supply, access, and seasonal variability of water in a Bolivian squatter settlement. *Soc. Sci. Med.* 67, 2116–2125. doi: 10.1016/j.socscimed.2008.09.042

Zwarteveen, M., and Meinzen-Dick, R. (2001). Gender and property rights in the commons: examples of water rights in South Asia. *Agric. Human Val.* 18, 11–25. doi: 10.1023/A:1007677317899