GROUNDWATER GOVERNANCE IN SUB-SAHARAN AFRICA

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Groundwater governance in the Arab World

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Table of contents

Figures

Foreword

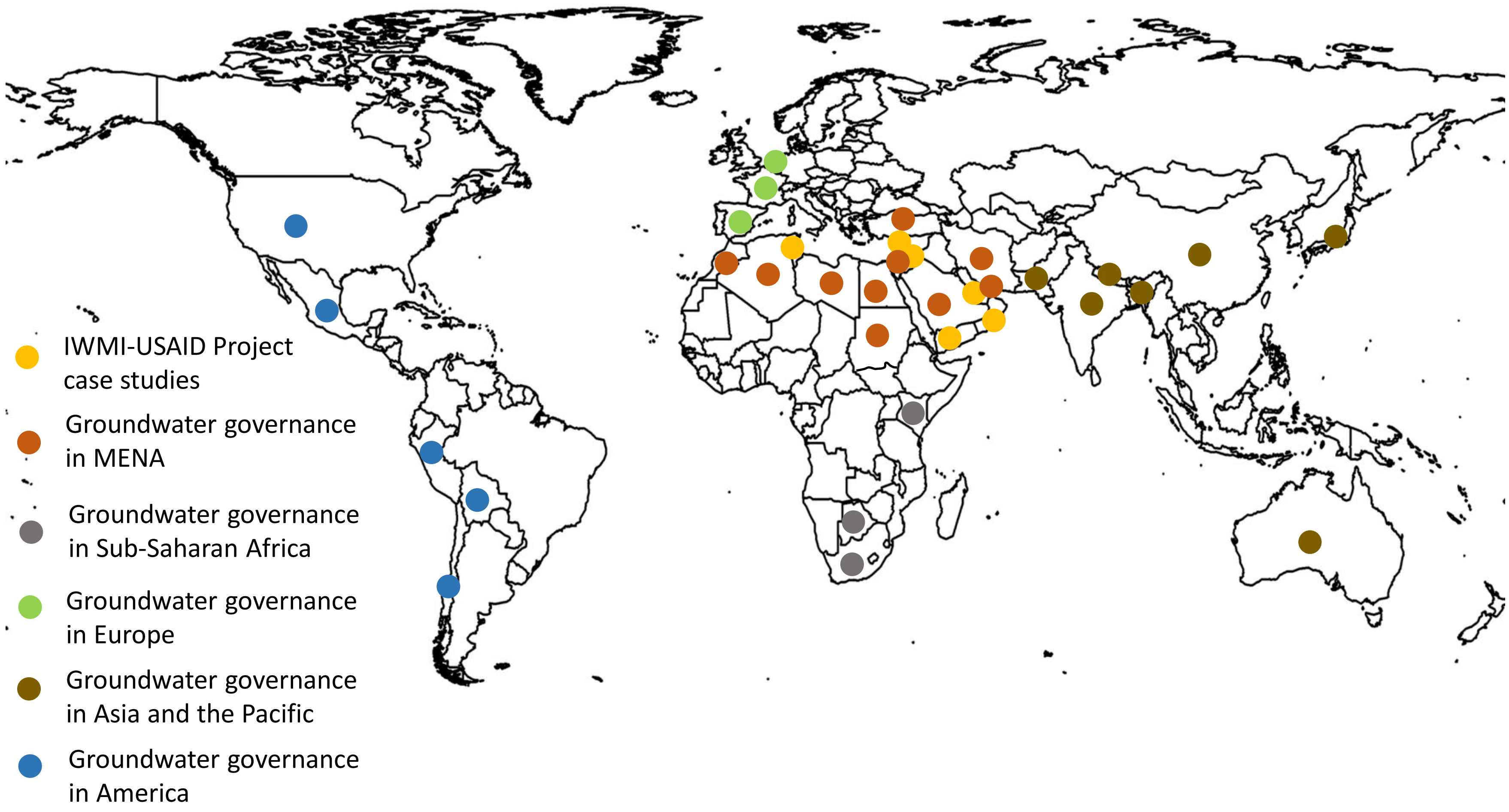
This report on groundwater governance in Sub-Saharan Africa is part of a series of five regional reports arising from a research initiative undertaken by the International Water Management Institute (IWMI) and funded by USAID aiming to address the challenges posed by the unsustainable use of groundwater in the Middle East and North Africa (MENA) region (Figure 1). Groundwater over-abstraction is a phenomenon threatening the sustainable economic and social development of the countries on the southern side of the Mediterranean and the control and management of over-abstraction has become a clear challenge for policy-makers, managers and academics in the region. This broader research exercise is aimed at presenting different governance problems and challenges that exist around the world regarding groundwater and inform potential future management and policy pathways in the MENA region.

The reason for this report on groundwater governance in Sub-Saharan Africa arises out of the necessity to examine, at various scales, existing cases of groundwater regulation and management so that policy discussions, effective solutions, and mitigation measures to the groundwater crisis may be found. This report analyses the different policy and regulatory experiences in groundwater management found in Sub-Saharan Africa so that relevant policy and management lessons can be drawn from these cases. The countries reviewed in this report are Kenya, South Africa, and Botswana. The report analyses, through a political, regulatory, and historical lens, the different groundwater regulatory tools, reflecting on the different laws, regulations, community actions, and institutional structures found in the different countries in order to curb groundwater over-abstraction.

Although this report does not attempt to be exhaustive as it is based on existing and accessible literature, it aims to go further than what has been presented until now and address the intrinsic challenges faced by current groundwater policies whilst offering a number of analytical and factual elements on groundwater governance presented in an original way. Semi-arid and arid countries are understandably more likely to (over)exploit their groundwater resources and the lessons drawn from the situation in other arid areas with different political economies, can potentially be very relevant for the MENA region as they may indicate potential solutions or -more often than not- flag the dangers or irrelevance of certain standardized, or seemingly desirable, policies. Thus, the examples studied here can provide a deeper understanding of the challenges countries in the MENA region face when it comes to reducing groundwater abstraction, echoing some of the attempts to regulate groundwater abstraction made by states in Sub-Saharan Africa.

The results and failures faced by governments and communities can also represent relevant insights when it comes to enforcing regulation or understanding legal barriers to policy implementation, all relevant and important lessons for other countries. Reflecting on a wealth of background stories and experiences will also provide a richer understanding and diversity of insights to these problems, what worked and did not work. The gravity and complexity of the situation require a systematic and wide-ranging approach building on existing knowledge and practices in and beyond the region, so that innovations in groundwater regulation and legislation can be found and the groundwater depletion trend averted.

Figure 1. Project case studies and cases reviewed for the project



1 Groundwater abstraction and management in Sub-Saharan Africa

Groundwater is abundant in Africa and the major source of drinking water (MacDonald et al. 2012), providing also an important buffer to climate variability (Altchenko and Villholth 2015). It is estimated that 30 percent of the urban poor in Sub-Saharan Africa (SSA) rely on groundwater via shared wells, boreholes, public taps or vendors (Chakava et al. 2014). This resource is however unevenly distributed, with the largest volumes found in sedimentary fossil aquifers in the north of the continent. Smaller aquifers below the Sahara desert are capable however to support handpump abstraction yields (0.1 to 0.3 litres per second) "and contain sufficient storage to sustain abstraction through inter-annual variations in recharge" (MacDonald et al. 2012: 1). Groundwater storage in Africa is estimated at 0.66 million km3, a much larger quantity compared to surface water storage in lakes (0.033 million km3) and annual average rainfall (0.02 million km3) (MacDonald et al. 2012).

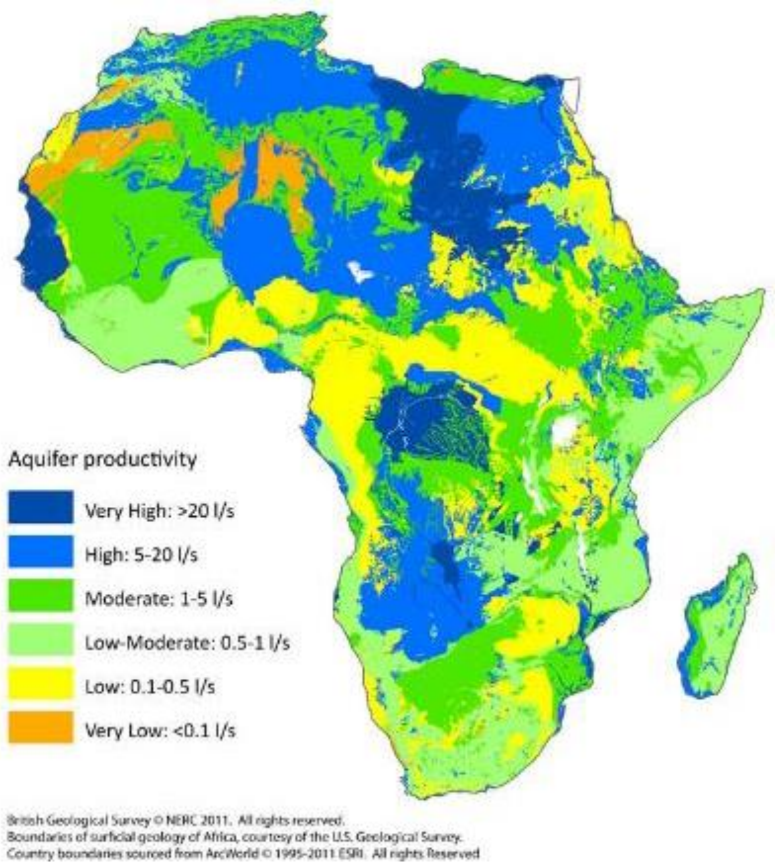
In spite of the fact that most aquifers with high yielding capacity are found in the north of Africa, research by the British Geological Survey uncovered that, given aquifer productivity in Africa (Figure 2), appropriately designed and located handpumps and boreholes will be able to sustain community access to groundwater in many countries in SSA (ibid.). In spite of such productivity levels, Edmunds (2012) is careful to observe that specific aquifer yields across Sub-Saharan Africa are more suited to rural development than urban drinking water supply or major agricultural development. Renewable and non-renewable aquifers need to be identified to prevent unsustainable abstraction (ibid.). Despite its abundance, groundwater-fed irrigation only contributes to approximately 1 percent of the total share of cultivated land (Altchenko and Villholth 2015).

Although groundwater in SSA is an important resource for cities, service provision tends to be informally organized and only a few large urban water utilities – e.g. Abidjan in Ivory Coast, Bamako in Mali, and Lusaka in Zambia – use groundwater as a permanent source of supply (Foster et al. 2010b). However, the use of privately owned wells for direct water collection has become the fastest growing source of urban water (according to some estimates, 24 percent of the urban water supply is collected from water wells) (Jacobsen et al. 2012).

Murray-Rust and Fakhruddin (2014) have explored the increase in groundwater exploitation in rural areas of West Africa. Even though groundwater is a driver for development, its access and use needs to be balanced out with the depletion of the resource and with the feasibility of infrastructure installation, finance, and maintenance (especially in remote rural areas) (ibid.). The regional assessments of the impacts of climate change indicate that increasing rainfall variability will reduce recharge. This, coupled with increasing population growth (both in urban and in rural areas) will reduce access to drinking water resources. Technology change however poses the greatest threat to groundwater sustainability, as the promotion and commercialization of both diesel and solar pumps inevitably leads to the intensification of groundwater abstraction (ibid.).

The challenges with regard to groundwater in SSA are also linked to the level of information and understanding of groundwater in the region. In Sub-Saharan Africa, many recent research papers and reports (e.g. MacDonald et al. 2011; Giordano 2006; Wang et al. 2010) underline that little is known about the actual role of groundwater use in supporting agricultural livelihoods in the region, or opportunities to expand this role in the future. There is a gap in information on the scale and temporal and spatial distribution of groundwater recharge across much of Africa. Most existing recharge estimates have been done on an ad hoc basis and at a very small scale, using very different methods and data, so that there is no consistency between estimates in different regions. The distribution of these estimates across Africa is also patchy and unequal (Wang et al. 2010).

Figure 2. Aquifer productivity in Africa



Note: According to the authors, this map indicates the different yields boreholes reasonably expected in the different hydrogeological units across the continent. Ranges "indicate the approximate interquartile range of the yield of boreholes that have been sited and drilled using appropriate techniques."
Source: MacDonald et al. 2012.

A study by Pavelic et al. (2012: 267) emphasizes that data on groundwater systems throughout SSA is sparse and that "the current state of knowledge creates a barrier to sustainable groundwater development". Sub-Saharan Africa has however had a long tradition of small-scale rural groundwater use, especially for domestic water supply in rural Africa (MacDonald et al. 2011) and supporting poverty reduction through irrigation. The development of the region's relative abundance of groundwater[1] and possibilities for management is challenging as the lack of information, human resources, data available on aquifer yields and abstraction undermines the potential development of this resource (Pavelic et al. 2012). As far back as three decades, the potential to expand the limited amount of groundwater-fed irrigation was judged to be significant (World Bank 1981 in Pavelic et al. 2013), a situation that has largely remained unchanged to the

[1] Large groundwater reserves in sub-Saharan Africa are found in the major sedimentary basins and can also accommodate high-yielding boreholes but they are often far from population centers and associated with deep water-levels (MacDonald et al. 2011). The study by Pavelic et al. (2013a) confirms these findings in 13 countries across a broad range of aquifer characteristics and climate regimes.

present (Pavelic et al. 2013). Smallholder irrigation, which encompasses GWI but also other sources, has thus emerged as a new priority in SSA to accelerate agricultural growth and enhance food security and the livelihoods of households in rural areas (Pavelic et al. 2013b).

In Uganda for instance, small scale groundwater abstraction is widespread with more intensive abstraction developed for urban areas. Aquifers in Uganda are found at relatively shallow depths and wells in rural areas are usually installed with hand pumps, with yields commonly ranging from 0.5 to 5 m3 per hour. Although there are an estimated 20,000 deep boreholes and around 3,000 shallow wells in the country, agriculture is mainly rainfed with smallholders and subsistence farming (MacAlister et al. 2012). In the Hadejia-Nguru wetlands in Northern Nigeria, the move towards deeper boreholes in some parts of the wetlands is economically motivated in order to offset the impacts of falling groundwater levels in the shallower aquifer (Acharya and Barbier 2000). Moreover, groundwater recharge has proved to be of considerable importance to wetland agriculture and reduced recharge creates high welfare losses for floodplain populations of small-scale irrigation farmers (ibid.).

For small-scale irrigation with groundwater in SSA, Chokkakula and Giordano (2013) refer to the lack of groundwater-fed irrigation spreading in the region due to limited policy and institutional support for groundwater irrigation development. However, indirect factors such as the unaffordable costs of drilling and pumping for small landowners due to poor marketing systems and trade barriers on equipment also limit the expansion of groundwater abstraction (ibid.). The overall quality of pumps available for example in Ghana is low, and inefficient marketing channels mean that prices for the same pump model may vary widely between locations. The price of energy such as fuel is also high in most of SSA and diesel prices are usually higher than electricity. Although farmers have no other choice, as the degree of rural electrification is very low or very unreliable when available, these overall costs impact their decisions to invest in irrigation pumps.

Moreover, banking systems across SSA generally are not strong, and the financial institutional structure ventures is poor, which decreases the capacity of farmers to access credit. Lack of security in land tenure is another relevant factor making investment in groundwater abstraction systems riskier. More than 80 percent of the land in Ghana is under the administration of customary laws (Sarpong 2006 in Chokkakula and Giordano 2013). This means that disputes are subject to heterogeneous tribal regulations. Rights are also not always clearly defined and the vulnerability of ownership and insecure rental arrangements discourages small landholders from making long-term investments (Chokkakula and Giordano 2013). Research by Villholth et al. (2013) in the Usangu Plains in Tanzania also confirmed also this trend. Their analysis shows that farmers are faced with limited access to groundwater production inputs. Major constraints were found to be related to the farmers' limited financial means together with a lack of supportive structures for groundwater abstraction (drilling policies, extension services, and pumps) (ibid.).

In Ethiopia, groundwater is the most common source of domestic water within the Blue Nile Basin, supplying at least 70 percent of the population. Strategic planning regarding groundwater resources has envisaged the increase in abstraction and consumption of groundwater for Ethiopia with a target of 100 percent of domestic water needs for the rural population supplied with groundwater by 2012 (MacAlister et al. 2012). At the country level, according to a report by the groundwater expert consultant team of the World Bank (GWMATE 2011) groundwater is of paramount importance for Ethiopia as a way to supplement available surface water resources (for drinking water, economic development, and climate variability mitigation). The hydrogeology of the country is however complex and only partly understood. The level of groundwater development is incipient and key water organizations such as the Regional Water Resources

Bureaus are understaffed and in need of drillers, hydrogeologists, and water supply engineers. An ambitious plan to end poverty in Ethiopia envisaged between 2006 and 2011 included the development of 2,986 deep wells, 20,817 shallow wells, 108,308 hand dugwells, and 14,657 spring improvements (ibid.).

For Ethiopia, the most pressing policy adjustments needed for groundwater management are the stronger integration of groundwater development and land use planning as well as integrating general water resource programs (e.g. water shed programs, drainage and flood plain development) with groundwater management (recharge, retention and reuse). Groundwater regulation for this group of experts needs to be scaled up and different organizational responsibilities need to be scaled up (federal, regional and river basin level) (ibid.).

2 Groundwater governance in South Africa

2.1 Groundwater resources in South Africa

As much as 80 percent of South Africa is underlined by shallow and weathered fractured rock aquifers with relatively low-yielding capacity (Tewari 2012; Woodford et al. 2009). High-yielding aquifers are found along the coast and in the north of the country (with dolomitic and quarzitic aquifers) (Tewari 2012). These aquifer systems typically consist of sands, gravels, and unconsolidated materials. This geological diversity causes aquifer yields to vary greatly across South Africa. Quantifying accurately groundwater contributions to ecosystems is challenging however due to South Africa's heterogeneous and anisotropic fractured rocks (Levy and Xu 2012 in Kotze et al. 2012; Wright and Xu 2000). Vast sedimentary areas present low yields (1 l/s or less) (Tewari 2012). High yielding aquifer varieties (more than 5 l/s) are however rare (alluvial deposits would yield between 3 and 8 l/s and coastal sands between 3 and 16 l/s) (ibid.). Boreholes located in fractures and dolomite faults and supplying water for mining operations (e.g. gold) can abstract up to 500 l/s and more. Groundwater recharge in these dolomite and sedimentary areas can reach 25 to 31 percent of annual rainfall (ibid.).

Aquifers in South Africa are extremely vulnerable to pollution. This is due to the fact that most usable groundwater is found within 60 metres below the surface and to the fact that 80 percent of South Africa's aquifers are fractured thus increasing the velocity of pollution spreads given the high porosity of the medium (travelling between 10 and up to 1,000 times faster than in non-weathered materials) (Tewari 2012). Even though they represent a smaller portion of the country's water demand behind agriculture and urban consumption, mining activities are a large local consumer of groundwater in South Africa and "probably the most direct cause of groundwater pollution through acid mine drainage" (Bourne 2002 in Tewari 2012: 183).[2] Irrigation and farming activities are also a source of pollution, causing salinization from return flows and drainage (Tewari 2012).

Groundwater is increasingly abstracted in the country, contributing to 15 percent of the total volume of water consumed, with irrigation representing the largest share, around 78 percent in

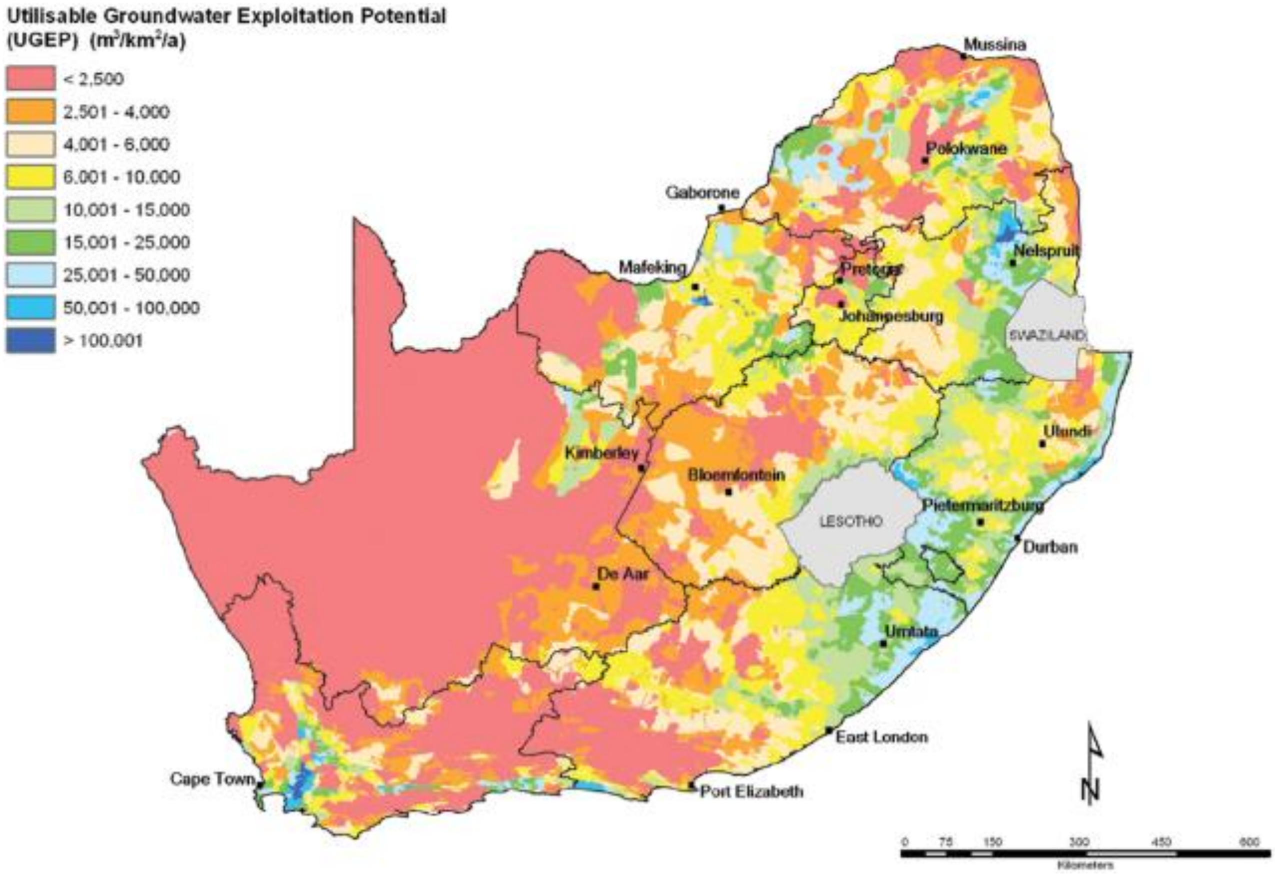
[2] Acid mine drainage is a phenomenon that arises from the mineral pyrite coming into contact with oxygenated water. In gold mining, crushed rock once the gold has been extracted is deposited on waste heaps (containing around 3 percent pyrite) (McCarthy 2011). Rainwater oxidizes the pyrite forming sulphuric acid which washes away and percolates through the dump while dissolving heavy metals in transit, emerging from the base of the dump as a pollution plume. Coal mining with underground mines can be prone to collapsing or when mining terminates, voids in fractured rocks can fill with water. Water turns acidic as a reaction to the contact with the pyrite contained in coal. Rainwater in opencast mining penetrates through the soil and becomes acidified (ibid.).

1980, down to 64 percent in 2009 of the country's groundwater use (Tewari 2012; Woodford et al. 2009). Mining, another economically strategic sector for South Africa contributing to 10 percent of the country's GDP, uses 3 to 4 percent of available water resources in the country and approximately 85 percent of the mines use groundwater as their water source (Pietersen et al. 2011). Groundwater abstraction is also stimulated by technology access and also the electrification of rural areas as the country's groundwater reserves are still under-developed (ibid.). The established potential of renewable groundwater in South Africa has been estimated by the Department of Water and Sanitation (previously the Department of Water Affairs, DWA), at 10.34 Bm3 per year of which 2 to 4 Bm3 are currently used (DWA 2010).

Groundwater is a strategic resource in South Africa, especially for rural communities. Over 80 percent of rural communities in the Northern provinces and KwaZulu-Natal depend on groundwater whilst 50 percent of communities in the Eastern Cape Province depend on that same resource (Pietersen et al. 2011). Moreover, some of the country's main cities also rely on groundwater for their drinking water supply. Cape Town is considering developing future water supplies from aquifers close-by, and the Capricorn District Municipality derives more than 60 percent of its water supply from groundwater (ibid.).

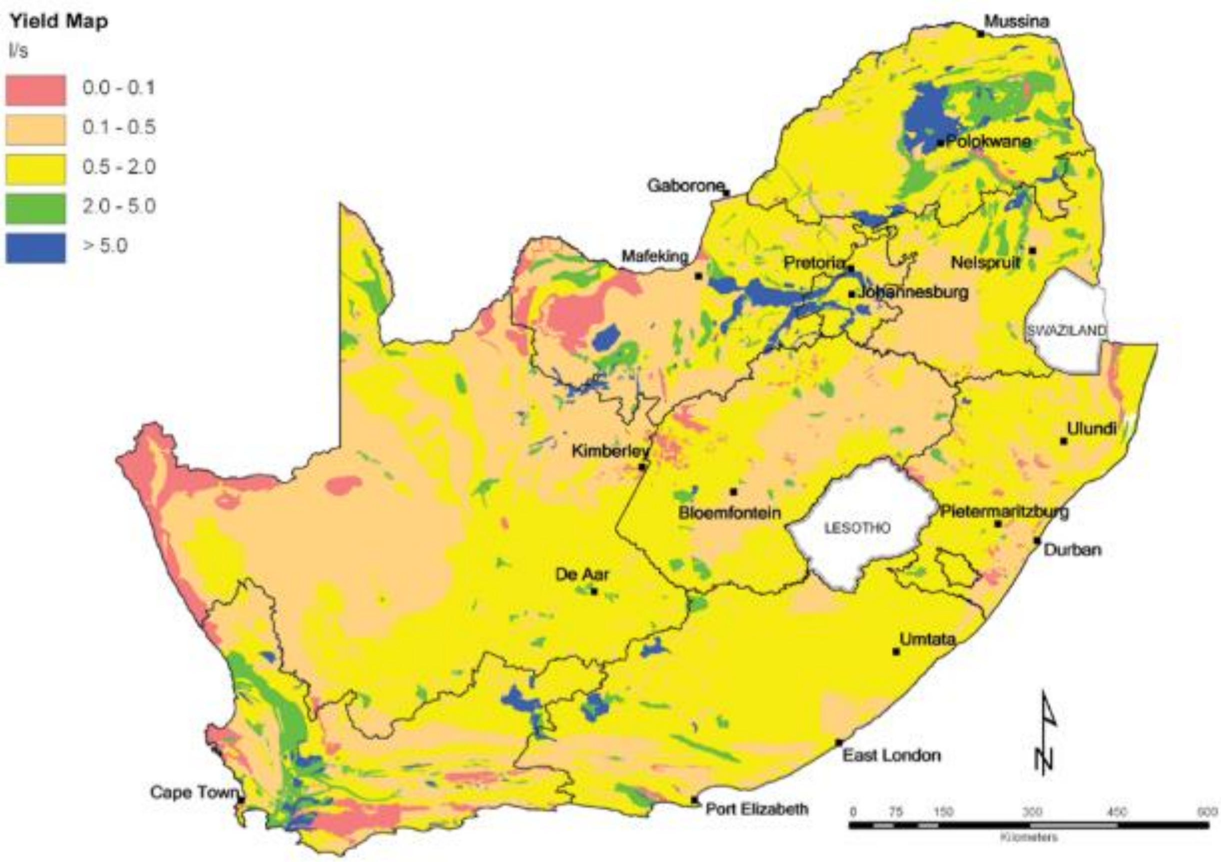
Estimates for the Limpopo province in the north-east of the country for example count more than 100,000 boreholes, with around 100 boreholes drilled every week (the success rate for yielding groundwater is around 66 percent) (DWA 2010). These boreholes are typically around 70 meter deep, found predominantly in metamorphic geological settings. Groundwater use in the Limpopo basin increased by almost 40 percent between 1995 and 2002, mainly for commercial agriculture ventures, leading to groundwater depletion and water table drawdowns of more than 50 meters after decades of overuse (Busari 2009). In that area, fractured water bearing materials have been the sole source for irrigation (ibid.).

Figure 3. Utilizable groundwater exploitation potential



Source: DWA 2010.

Figure 4. Aquifer yield map of South Africa



Source: DWA 2010.

2.2 Water resources management and legislation in South Africa

Major policy and institutional reforms in South Africa have always been preceded by, or occurred during, drought episodes and major political changes in the country. This is true as Backeberg (2005) writes for the new water legislations of 1912, 1956, and 1998, preceded by political changes such as the unification in 1910, the election of the National Party in 1948 and the end of the Apartheid and election of the African National Congress in 1994 (ibid.). In view of several drought episodes in the 1950s, the apartheid regime sought a technocratic and engineering approach to control water resource in South Africa (Beckh 2013). This was coupled with a command-and-control management structure run by a centralizing bureaucracy. Water ownership was linked to land, leading to great inequalities in water access as the ownership of the land was controlled by a white minority (ibid.).

Before 1994, water related policy was limited to irrigation and forestry. Water supply responsibilities were fragmented and no single national agency was responsible for it. Apartheid water regulation granted private abstraction rights to whoever owned the land (white people only) (Pietersen et al. 2011). Institutional reforms in South Africa after 1994 happened as a combination of sudden and gradual change (Backeberg 2005). Between 1994 and 1997, country-wide consultations with stakeholders through provincial and national workshops and public hearings resulted in the publication of a series of key documents (Water Law Principles in 1996 and Resource Pricing Policy for South Africa) (ibid.). This process culminated in the Water Supply and Sanitation Policy in 1994 and the Water Services Act in 1997 followed by the National Water Act in 1998 (ibid.).

The National Water Policy from 1997 was based on a series of principles, treating surface water and groundwater equally. Water is to be owned publicly and users are granted rights or authorizations to use it (Pietersen et al. 2011). For groundwater, new wells need to be registered as well as drillers and specific areas can be declared as 'sensitive' where notice of intention to drill is required. The National Water Act (1998) which emerged out of the National Water Policy is based on three pillars: social equity, economic efficiencies, and environmental sustainability. A further document, the National Water Resource Strategy (2004) described in general terms the application of these laws (ibid.).

As Seward (2010: 239) wrote however, one of the problems about the 1998 Water Act is that "misunderstanding still abounds regarding the environmental aims of this legislation." This has to do with the objective stated in the Water Act to allocate a minimum quantity of water (called reserve) to protect human needs and aquatic ecosystems and the seemingly 'bucket analogy' used to quantify and manage groundwater, not specifying the threshold between acceptable and non-acceptable management and abstraction, and creating the "false impression, however, that everything that is left over once water is allocated for the ecological and basic human need Reserves can be allocated for 'consumptive use' without impacting the Reserve" (Seward 2010: 242).

In 2007 the Department of Water Affairs started formulating a National Groundwater Strategy in order to address the shortcomings of the National Water Resource Strategy with regard to groundwater. The 2010 Groundwater Strategy was designed in order to make sure that groundwater is recognized, used, and protected as an integral part of the country's natural resources. It was issued after 3 years of consultations and was funded by the Danish International Development Agency and became part of the country's National Water Resource Strategy (Ali 2012).[3] The Groundwater Strategy promoted the inclusion of groundwater in further revisions of the country's National Water Resource Strategy as well as subsequent water management plans, proposing improved groundwater quality management and monitoring rules, and the implementation of stricter groundwater regulations (ibid.). The procedure for license applications was to be accommodated, according to the National Water Resource Strategy, to marginalized and disadvantaged groups to ensure that water is allocated fairly (Backeberg 2005). Administrative and structural problems have however delayed and affected this process as there is a "severe shortage of technical capacity, an inordinately long water use license application process, […] incorporating the public participation process, and revising policy implementation processes to accommodate highly localized aquifers" (Seward 2010: 239).

The country is divided into 19 different Water Management Areas, each one of them 'managed' by a Catchment Management Agency (CMA). At the regional level, CMAs would be responsible for the day-to-day management of groundwater resources. For aquifers spanning across different WMAs it was proposed that an Aquifer Management Committee would be established: an

[3] The National Water Resource Strategy saw its first edition published in 2004 as part of the mandate of the DWA and as mentioned in the National Water Act. This document covers most areas of water resource management in the country and needs to be reviewed periodically (not exceeding 5 years). It is a binding document for all administrations and organizations with a duty to exercise power over water management.

advisory body set up by the various users and stakeholders in the catchments to provide strategic input to the assessment, planning and management of groundwater (Pietersen et al. 2011).

Although it is envisaged that CMAs will be financially self-sufficient, the process of creating them was brought to a halt after 2007 until the Department of Water Affairs' institutional realignment project was finalized (ibid.). There were concerns about the limited technical human resources and low revenue base of some of the envisaged CMAs (ibid.). This institutional project rejected the initial idea from 2004 to create 19 different CMAs and recommended the establishment of 9 CMAs (ibid.).

South Africa's second National Water Resource Strategy was issued in 2013 and, unlike its earlier version which had as its over-arching goal the development of IWRM (International Water Resource Management), this one introduced the concept of 'developmental water management' (van Koppen and Schreiner 2014a). IWRM according to van Koppen and Schreiner (2014a) was not seen as an end in itself but, rather, placed water access and service delivery via infrastructure at the centre stage, trying also to operationalize equity. The difference with this second strategy is that it subjected water to the country's developmental state of equitable, redistributive, and broad-based social and economic development (ibid.).

2.3 The regulation of groundwater abstraction with the 1998 National Water Act

Before the National Water Act in 1998, groundwater had been managed separately from surface water and given the status of a private resource owned as a private asset coupled to property rights, following the riparian doctrine (Knuppe 2011).[4] With the new Act, water (including groundwater) is to be priced and charged for every use and person registered, or holding a license to use water. With the new Water Law, the state became the 'custodian' of natural resources and was to issue authorizations to users to utilize and abstract water. Water was to be managed by the Department of Water Affairs (DWA, currently the Department of Water and Sanitation) with overall responsibility over use, allocation, and protection. Responsibilities were also decentralized with the creation of regional and catchment level administrations: the DWA's regional offices and Catchment Management Agencies (see above), responsible for the management of water resources within the 19 defined water management areas (ibid.). The 1998 National Water Act, according to Movik and de Jong (2011: 70), represented the "introduction of the public trust doctrine and a concomitant shift from user-user to State-user relations in terms of water use rights." This system represent a change where "the imposition of administrative water use, the granting of licenses was no longer derived from legal basis of land ownership (which was highly discriminatory) but from the discretion of the State in terms of considering the eligibility of individual applicants to hold a license" (Movik and de Jong 2011: 72). The process of registration and approval of groundwater uses is slow, however, resulting in an authorization system backlog (Pietersen et al. 2011).

There are five types of groundwater use authorizations recognized by the 1998 National Water Act (Anderson et al. 2007; Kotze et al. 2012):

[4] The distinction between public and private waters was first introduced by the Irrigation and Conservation of Waters Act in 1912. It was based on the principle that landowners could own the water flowing from springs and through their land provided that availability was ensured for downstream riparians (riparian rule). This distinction and rule was also maintained in the 1956 Water Act (Ali 2012).

1) ***Schedule 1***: these are groundwater entitlements used for reasonable domestic purposes, small garden plots, and livestock. Users are not required to register this type of use. No charges are applicable if water or groundwater is taken directly from the source.

2) ***Existing lawful water use***: this particular category was created as a mechanism to bridge the gap between the old water legislation and the new National Water Act, "intended as an interim measure to allow water use to continue until converted to a license".[5] This Lawful water use represents an allowance for users to continue using the level of water that lawfully took place during the two years before the enactment of the National Water Act. The origin of this idea was to avoid the high costs of revoking all existing use rights prior to the National Act, which would have caused "a barrage of cases to be brought against the State" (Movik and de Jong 2011: 72). These abstractions have to be validated and verified however (in order to confirm how much water was being used during the two years prior to the promulgation of the National Water Act and whether it had been correctly registered and the water use was lawful and fair depending on the use and volumes for irrigation, hectares owned and used, and types of crops).[6] With compulsory licensing, these registrations will be converted to licenses with a specific abstraction volume authorized. With its registration, the use is authorized unless the water user wants to increase the water use (in that case a new license has to be issued) or unless 'compulsory licensing' is introduced in the catchment by the DWA, so in that case all users are asked to apply for licenses (Department of Water Affairs and Forestry 2006). Compulsory licensing is a mechanism contemplated in the National Water Act by which all water uses in a catchment are reviewed and water is reallocated if necessary to users having applied for a license. This is a lengthy process according to Movik and de Jong (2011: 76) due to the administrative burden for the Department of Water as applicants can appeal to the Water Tribunal "if they are not satisfied with the proposed water allocation." Following van Koppen and Schreiner (2014b), the registration of existing lawful use it not seen as licensing, rather, it only "improves claims to water in future licensing" once the entitlement has been registered in the Water Authorization and Registration Management System database.

3) ***General authorizations***: groundwater abstraction rights granted through authorizations are limited to domestic water use, livestock watering, and non-commercial irrigation purposes. General authorizations include water usages that cannot be covered by a license but that require more water than what it is permissible under Schedule 1. Depending on the extent of the farm, commercial irrigation was authorized for users with general authorizations (for very large farms) but in 2012 new rules on general authorizations stipulated that no more than 40,000 m3 of groundwater can be abstracted per year with a general authorization, and groundwater has to be used on the property. The Government further established a maximum volume of groundwater to be abstracted depending on the surface of land owned by the user.[7] These general authorizations, according to Anderson et al. (2007: 166), provide a tool to authorize water use "without the administrative burden of processing and applying for individual licenses" and can be delegated to the regional level. General authorizations are also not defined for a specific category

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[5] Department of Water and Sanitation, Republic of South Africa, www.dwa.gov.za/WAR/determine.aspx (Accessed 18th of August 2015).

[6] This verification is done based on previous records, information provided by the user (in the file and through interviews) and also remote sensing and satellite imagery. Department of Water and Sanitation, Republic of South Africa, www.dwa.gov.za/WAR/determine.aspx (Accessed 18th of August 2015).

[7] Depending on which part of the sub-catchment the permit is issued, abstraction will change (abstraction rates to be multiplied by the size of the property vary from 0, 45, 75, 150, 275, and 400 cubic metres per hectare per year) (Notice 288 of 2012, Department of Water Affairs, Government Gazette, 4 April 2012, No. 35223, http://www.gov.za/sites/www.gov.za/files/35223_gen288.pdf, Accessed 10th March 2015).

of user "but can be taken up by all users within the specified area" (Anderson et al. 2007: 170). These general authorizations were initially considered to be temporary entitlements "to allow small volumes of water to be taken up before the licensing process was formalized" but have now been used "to promote uptake of water by Historically Disadvantaged Individuals (HDIs) in support of water allocation reform" (ibid.).

4) ***Groundwater use licensing:*** groundwater abstraction requests exceeding the general authorization limits have to apply for a groundwater use license. These include for example certain non-commercial irrigation uses (e.g. due to fractioned small landholdings). Licenses also include bulk water supply, mining activities, and irrigation schemes. Licenses are differentiated between 'single water use licenses' and 'integrated water use licenses' applications. Licenses require hydrogeological assessments carried out by the Department of Water Affairs. According to Funke and Jacobs (2011), around 15 percent of all water use licenses are allocated to historically disadvantaged individuals.

5) ***Controlled activities***: as part of Section 37 of the 1998 National Water Act, irrigation with waste water of with recycled water power generation activities, aquifer recharge (with wastewater or without) are considered controlled activities by the Department of Water Affairs and require a different type of authorization.

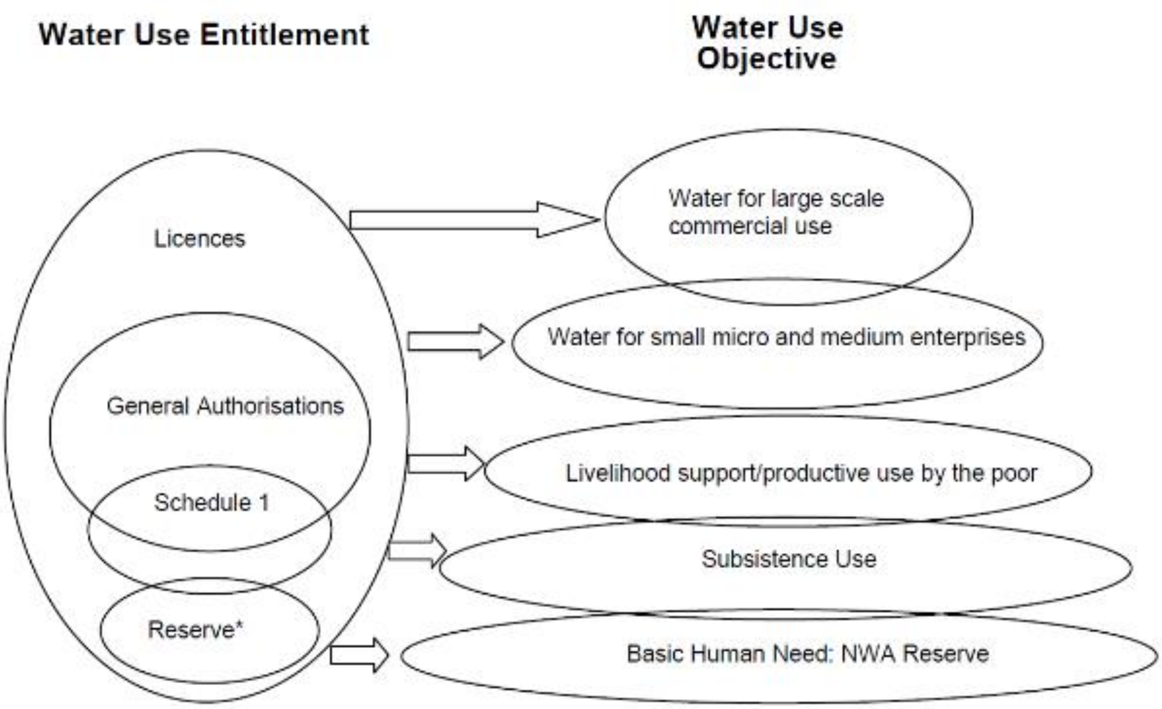
The process to grant a license for water use is initiated by a responsible authority (be it the catchment management agency or the Minister if no agency has been created), which issues a general invitation to all existing and potential users to apply for a license within a specified area (i.e. the catchment) (Anderson et al. 2007).

Once the applications are received, the responsible authority proposes an allocation schedule outlining how water will be allocated to each applicant which is published in the Government Gazette for comments (ibid.). After the authority has received objections and comments it prepares a preliminary allocation schedule to be published in the Gazette. Users can appeal to the Water Tribunal which has the power to require amendments to the allocation schedule (ibid.). The responsible authority must take all necessary steps "to communicate the contents of the notice [of schedule] to interested persons and to consider all of the comments received on or before the date specified in the notice" and communication channels such as radio, farmer associations, and catchment forums have to be used to inform community members (especially for disadvantaged communities) (Anderson et al. 2007: 172).

The General Authorization notice issued will determine an upper allocation limit for the cumulative use of water among all users (Anderson et al. 2007). General Authorizations will be granted on a first-come first-served basis until the upper limit is reached. The limit is however based on an assessment of the available resource, the likelihood for productive use under the general authorization regime, and the demands from other users. The notice has also to specify an individual volumetric cap (which can be based on an estimate of the minimum sustainable yield) (ibid.).

General authorization notices are issued in general for a period of 5 years. In areas however where there is risk of drastic reduction of water levels this period could be shortened. As described by Movik and de Jong (2011: 75), license applications have to go through an area or regional office official from the Department "in order to determine the water use category within which their water use should be authorized. If the water use falls into the licensing category, the applicant and the Department official have to gather information related to the water use, the catchment area as well as the Reserve for the area in order to determine the amount of allocable water in the area in which the water use will take place. When all the information, such as title deed, application forms concerning the water use, technique used to capture the water, risk assessment and reserve determination, is gathered by the applicant and the Department official, and once payment for the application is received, the application is filed […]. From this point onwards, the application is reviewed at the Regional Office level and it is later sent to the National Office for final decision." At the end of the period, the responsible authority can reconsider the length of the period, extent of abstractions and state of the resource. The General Authorization can be closed, extended, or re-issued under different conditions. Trading amongst users and holders of General Authorizations is possible once the process for granting authorizations is closed (Anderson et al. 2007).

Figure 5. Water use entitlements in South Africa



Note: Reserve use does not constitute an entitlement mechanism but a right guaranteed in South Africa's constitution. Every citizen is entitled to a certain amount of water a day (25 litres per capita per day).
Source: Anderson et al. 2007.

2.4 Groundwater regulatory and management challenges in South Africa

2.4.1 Enforcement problems

Even though South Africa's legislation on water has been described as 'forward' and 'progressive' in theory, its tangible implementation is seen by some observers as weak to non-existent (Seward et al. 2015). Enforcement and respect of formal regulatory tools and laws is weak in South Africa, as proved by Beckh (2013) in Gauteng province. Interviews of a series of experts from government, academia, and social organizations in that province highlighted how people "deliberately take advantage of the weak formal governance" as they "try their luck [o]r they know that there are not a lot of knowledgeable people in the department [DWA] or in government, or whatever" (Beckh 2013: 13). Farmers also still act "according to the old Water Act of 1956 and continue to claim their right to water based on private ownership" (ibid.). As Colvin and Saayman (2007) have also pointed out, "the social views of groundwater lag behind the formal policy of a public resource, and are tied more closely to land ownership". This presents a problem as there are still large vested interests by landowners exploiting groundwater for farming and commercial purposes and these users are not willing to give up their share, as the discourse and perceptions are still very much entrenched in the old mentality of private ownership of the resource (Beckh 2013).

In the City of Cape Town, the delegation of the Department of Water Affairs was found 'capacity-constrained', limiting the ability of its staff members to monitor groundwater and process license applications (which could take up to 9 months) (Colvin and Saayman 2007). The implementation of rules in the city is curtailed by a lack of administrative capacity and resources (ibid.). Cape Town's water resource management was dominated by the 'hydraulic mission' until the late 1990s, focusing on bulk water supply and not integrating demand management and household level groundwater use and development planning with its water strategies. Tellingly, in 2007 the city did not employ a hydrogeologist or groundwater engineer within its Catchment Management Area (ibid.).

2.4.2 Licensing and procedural problems

The issuing and regulation of groundwater abstractions through licenses has hit difficulties due to the administrative burden of a large number of licenses requested by small scale users as well as delays due to difficulties in obtaining all the information from applicants (Seward 2010). Under the new water law, it was expected that the authority to allocate licenses "would be transferred to the level of the Catchment Management Agencies […] however it has proved very difficult to set up CMAs and there are only three CMAs in South Africa to date, none of which has been given the full powers of licensing" (Movik and de Jong 2011: 68).

Additionally, the license process can take up to 2 years or more to complete, "and is often regarded as a tedious piece of bureaucracy rather than a powerful tool for ensuring sustainability, especially when license applicants usually expect the process to be completed in a few months" (Seward 2010: 242).[8] This backlog has meant that water use has been taking place without proper regulation and that illegal use abounds (only about 20 percent of groundwater use has been verified by the DWA) (DWA 2010). Additionally, monitoring of licenses barely takes place (it should be done every 5 years) "due to capacity constraints and the review process is mainly an administrative 'paper' monitoring process" (Movik and de Jong 2011: 72). The perception is, as reflected by Movik and de Jong (2011: 73), that users having received licenses do not perceive any advantage as "they observe that their fellow water users continue to draw water as before whereas they, who now possess licenses, have to pay fees and comply with the conditions in the license in order to be able to continue with their use."

The lack of knowledge and data on the resource represents an additional burden on the water administration went it comes to issuing licenses (Anderson et al. 2007). There is also an undervaluation of the importance and significance of groundwater resources in the country, possibly linked to the past private status of the resource as well as its invisible nature (Knuppe 2011; Riemann et al. 2012). These attitudes have been forged through generations and are difficult to change (Knuppe 2011). For many users, "a lack of clarity and unfamiliarity with water

[8] Out of a sample of 23 licenses studied from the Department database by Movik and de Jong (2011), the average runtime taken to process licenses was of 5.7 years (instead of the target of 5 months for the procedure).

registration has led to a situation in which many water users have not yet registered their water use and many of those who did, registered their water use incorrectly" (Movik and de Jong 2011: 74).

2.4.3 Staff and administrative problems

Human resources are lacking as well as socio-economic data related to groundwater resources and technical and professional expertise is missing at all management levels (from central to local levels) (Knuppe 2011; Seward et al. 2015).[9] These problems are emphasized by the perception by the state that the process of license granting can only be allocated through the formal authorization of licenses (an already highly bureaucratic and complex administrative process) (Movik and de Jong 2011). The Department of Water Affairs has "very limited capacity to evaluate and judge each application on its own merits, check on-site or enforce the licensing process. Administrative pressure, and the proven threat that vested applicants can report any delays to the Water Tribunal, pushes officials towards allocating whatever is being asked for" (Funke and Jacobs 2011: 90). The lack of trained officials in the DWA is due to an ageing workforce, the emigration of professionals and constraints of university and higher education systems (Anaman 2013). Low paid staff positions and poor working conditions driving candidates or staff to better posts somewhere else (Seward et al. 2015). In 2011 the Department of Water Affairs aimed to address the existing backlog of the authorization issuing process, increasing its target of successfully completed authorizations to 40 percent by 2014 (Funke and Jacobs 2011). Pietersen et al. (2012) stated that only 20 percent of groundwater use applications had been processed by 2012. There is also no explicit regulation for well and borehole drilling (Pietersen et al. 2012).

Additionally, reorganizational moves within the DWA have also affected its capabilities and already dwindling resources. The Department of Water Affairs began an internal restructuration in 2002-2003 (Pietersen et al. 2011). The two separate directorates of Hydrology and Geohydrology were abolished and a new directorate was created and named 'Hydrological services' (ibid.). The new Directorate of Hydrological Services deals with hydrogeological information as well as groundwater monitoring and assessments, water use and licenses, and planning. This organizational move dissolved however the Directorate of hydrogeology and redeployed the hydrogeologists to various directorates, and thus left the DWA without a central coordinating point for groundwater (ibid.). This is perceived as a problem and results in the inadequate coordination and support to regional offices and municipalities. The fact that no local government has its own groundwater expert increases the weaknesses of groundwater management at the local level (ibid.).

Another problem that has been mentioned is the level of centralization of the water administration in South Africa. The country's water management structures lack of integration structures between decentralized government bodies and the central administration making the exchange of and cooperation between levels and across sectors very difficult (Knuppe 2011). The Department of Water and Sanitation is an institution reluctant to devolve duties and responsibilities from the national office to regional branch offices (Seward et al. 2015). The organization also lacks of strategic thinking, is concerned with petty administrative issues

[9] These problems affect South Africa's public service as a whole as described by Seward (2015), not only the water sector. The author actually considers that it is a characteristic of the delivery of public service, preponderant in most sectors of government, which then transpires to the water sector.

overriding efficiency and effectiveness of service delivery, and has a culture of resistance to change (ibid.).

2.4.4 User inequalities

There are also disparities amongst users as for "administration-proficient, larger scale users, obtaining a license simply means submitting an application" (Funke and Jacobs 2011: 90). Large-scale commercial farmers use around 95 percent of water for irrigation and new users have to compete with well entrenched users for the available water (ibid.). New users in some instances are not fully capacitated to understand their water needs, scales, and rates of payment for water rights, use, and management or simply their responsibilities as members of Water User Associations (ibid.). These Associations have furthermore a limited role, "a watchdog for the higher-level institution or for providing inputs to that institution", and their powers and rules to manage water have to be directly delegated by the catchment management agency or the minister (Seward et al. 2014: 7). Furthermore, the process of compulsory licensing of commercial water uses had not started in 2011, with only three pilot studies carried out in the country. Also, "of the 1212 ad hoc licenses for new water use that had been allocated by 2006, 98% were for non-historically disadvantaged individuals" (Funke and Jacobs 2011).

There are also problems with the implementation of rules at the regional and local level due to social and cultural constraints related to stakeholders' "attitudes and traditional ways of thinking (e.g. property owner of groundwater, pumping rates for irrigation purposes, achievement of water licenses, etc.) as well as to uncoordinated and fragmented groundwater governance regimes" (Knuppe 2011: 70). According to van Koppen and Schreiner (2014a), the burden to apply for a license is enormous in terms of administrative costs, both for the DWA and users. These burdens however disproportionately hit small-scale remote illiterate users. Moreover, the existence and acceptance of the Existing Lawful Use as lawful under the Water Act reproduced, according to van Koppen and Schreiner (2014b: 70) "the immense inequalities in access to water and the profoundly discriminatory pre-1998 race, gender and class-based water use authorization system" as almost no black person had a formal water license right before 1998.[10] During the consultation period after 1994 leading up to the drafting of the Water Act, these vested water users did not want to lose their water rights and access to land (only 13 percent of the land was accessible to black South Africans, owned by the state with potentially transferable rights to these communities inhabiting the homelands) and the new government at the same time did not want to "completely disturb the functioning white agricultural and other sectors" (ibid.).

However, making water available for black farmers will still depend on how much water are white farmers willing to give back. This is due to the fact that a large part of the expertise and knowledge

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[10] Access to land and therefore resources during apartheid had a racial bias. Whites had appropriated 87 percent of the land in South Africa as well as related water resources (van Koppen and Schreiner 2014a). In the Lowvelt, by the 1980s the government sought a more formal separation between blacks and whites and designated specific 'homeland areas' where black people would be allowed to live, removing them from 'white' designated areas (Woodhouse and Chhotray 2005). The democratic process initiated in 1994 sought to redress historical injustices and social imbalances. A land reform programme intended to transfer approximately 30 percent of white-owned land to 'new' black commercial farmers by 2014 (Funke and Jacobs 2011). Land was also restituted to their previous owners, forcibly taken from their rightful owners during apartheid. Financial compensations were also granted (by the year 2009, this programme had only delivered 5.1 million hectares of land, acknowledging that 90 percent of all land reform projects had failed) (Pressley 2010 in Funke and Jacobs 2011). The 1998 National Water Act abolished water rights tied to riparian land ownership. It also abolished the distinction between private and public land. However, still existing hierarchies of power and privilege have formed historical patterns of power relations and there are concerns that even though historically disadvantage individuals have been legally included in the process, equity may still not be achieved through compulsory licensing of water uses (Anderson et al. 2007).

about local water management issues resides within the irrigation boards and also white farming sector (Woodhouse and Chhotray 2005). During the apartheid period, local commercial and farming interests achieved a high degree of decentralized governance over water use. The capacity for detailed local water management does not exist within the state's central water agency (the Department for Water Affairs and Forestry). This characteristic means, according to Woodhouse and Chhotray (2005: 10), that "the capacity of local (white) elites controlling resources such as water to resist national policies to redistribute access in favour of historically disadvantaged groups is high. The capacity of local black farmers to challenge this white domination of water resources is low, mainly due to ineffective and unfocused organizational and representative structures."

3 Policy change for groundwater management in Kenya

In Kenya, all water resources are vested in the state. Water use is subject to approval and permit issuing is controlled by the state (Mumma et al. 2011). However, groundwater is subsumed under broader water resource policy and institutional frameworks dealing with natural resources. According to a report on groundwater governance in Kenya (ibid.), despite the need for permits, many groundwater abstracters do not have any, and among those who have, many do not pay water charges. The same authors write that groundwater management also lacks a strategic focus and has limited resources (human and financial), caused also by the poor knowledge of the resource, limited technical capacities, poor funding and weak political commitment (ibid.).

An important regulation tool for groundwater abstraction in Kenya is the designation of Groundwater conservation areas (a measure contemplated by the Water Resources Management Authority and established by the Water Act in 2002) (ibid.). Despite these provisions, no groundwater conservation areas have been designated other than in Nairobi, which predates the enactment of the Water Act. An attempt to establish another of these conservation areas around Lake Naivasha has been made but it remains to be announced officially. The different policy issues identified regarding the over-centralization of decision-making processes, inappropriate monitoring levels and database, were still present during the time of the assessment made by Mumma et al. (2011).

The Water Resources Management Authority defined six catchment areas, set up in 2005 and headed by a regional manager. However, the definition of these areas had no consideration for groundwater resources and aquifer boundaries. This has resulted in overlaps between different catchment areas of groundwater resources, not taken into account by the institutional arrangements for surface and groundwater management (ibid.).

The Water Act of 2002 also provided for the establishment of water user associations and envisaged that, for groundwater resources, a user association could be formed for the management of the resource (ibid.). These associations are however not traditional, and are based on abstraction permits and not traditional water access rights. They are not uniformly spread across the country and only five groundwater-specific user associations had been formed by 2010 (ibid.).

In Nairobi, although the existing bulk water resources are sufficient, supply is not reliable during drought episodes, due to the poor state of infrastructure and distribution system (with losses up to 50 percent due to leakage, illegal connections, etc.) (Foster and Tuinhof 2005). Groundwater is therefore a strategic resource for the Greater Nairobi area where private wells represent 25 percent of the overall water supply of the population (2002 data) (ibid.). Most of the wells are operated by large private consumers (industries, hotel complexes) and also by residential owners in parts of the city receiving intermittent supply via the public network. Wells can be shared amongst neighbours or sold for distribution via water tankers (ibid.).

The use of private boreholes in Nairobi according to Chakava et al. (2014) represents an expensive but 'least bad' alternative to unreliable and erratic public drinking water supply. This supply is however at the expense of groundwater resources, declining by 3 meters every year in the authors' study site (ibid.). Water tariffs and quality standards are however not enforced, and average prices for consumers are over ten times the nationally approved lifeline tariff for piped water. Additionally, located sometimes within 100 meters or less of each other, boreholes do not respect statutory licenses regulating spacing (minimum 800 meters) (ibid.).

4 Community participation and groundwater management in Botswana[11]

4.1 Borehole syndicates in Southern Botswana

It is estimated that over 21,000 boreholes exist in Botswana, many of them not used and capped and many not registered. Half of the registered boreholes are owned by the government, the rest by private individuals (Colman 2013). In the Kgatlend District in Southern Botswana, the development and increasing use of water and rangelands was determined by complex socio-political, cultural and economic relations between people exercising various kinds of authority over herds, land, water, and one another. Facing growing pressure in the 1930s from more and more seasonably variable water supplies, livestock owners and colonial officials invested in deep wells with motorized pumps.

Arising from the access to new water resources, debates over the responsibility for the construction and maintenance of boreholes and pumps arose, taking place within already existing social institutions. As a result of the drilling of boreholes in the 1930s, syndicates of cattle owners who owned the grazing boreholes were established to run the new boreholes. These proved to be significant agents in changing the property relations over water and rangelands. Cattle owners in southern Botswana were envious of the boreholes that were proving so essential to successful ranching in the neighbouring areas of South Africa. For local herders, boreholes not only provided a constant and reliable water supply but would also cut labour needs in comparison with raising water from wells by hand, allowing more cattle to be watered year round by fewer herders. Boreholes would also facilitate a permanent use of pastures by cattle and herders.

The borehole-drilling program in Botswana, funded partially by the Colonial and Development Welfare Fund, not only introduced boreholes on a larger scale but also developed a new community structure: the borehole syndicate, "a product of the dialogue taking place between the protectorate administration and the Tswana chiefs about economic progress" (Peters 1994: 59). The syndicates were developed as the institutional form to partially self-fund, manage, and maintain boreholes for traditional grazing and livestock owning communities, becoming a new type of private group ownership of the resource. Initially, borehole drilling was financed via a general levy imposed on the tribe. However, the shortage of tribal funds and the intention by administrators to favour the responsibility and accountability of users in the management of the resource were reasons to implement the development of borehole syndicates on a large scale. Additionally, the view that communal property systems did not guarantee security of tenure and that would be obstacles to economic improvements and progress were also stated as reasons for the development of the program.

The initial issue of capital to develop and drill boreholes quickly shifted to the financial necessity within the syndicate to ensure the viability of the management and operation of the boreholes. Even though the administration and the state had been funding the drilling operation, by the end of the 1950s there were considerable financial and organizational strains that led to the discussion of how to shift the burden of cost and management to the users. As a result a loan scheme was developed to repay the government's investment in drilling and equipping boreholes. In 1974, the postcolonial state introduced the Dam and Haffir Building Policy with the objective of ensuring efficient and effective natural resource management for livestock watering and grazing (Manzungu et al. 2009; Peters 1993).

[11] Section based on Peters (1993) unless stated otherwise.

Rules were "premised on a strong state role in how resources were used" and with strict procedures for group organization, agreements, fee paying schemes, etc. (Manzungo et al. 2009: 212). The activities revolving around the daily management and organization of activities of a borehole syndicate have mainly to do with financial affairs, and especially the assessment and collection of hirers 'fees and members' contributions for fuel and repair costs. The syndicate needs to ensure that there is a sufficient and constant cash flow given the reluctance of cattle owners to accept additional payments other than the basic fee and a wide variation of wealth amongst syndicate members. Since for many households cattle is the only source of cash, many necessities are linked to the possibility of selling cattle to be able to pay for the costs of other activities, such as bride wealth or a social party, whilst trying to maintain a healthy and breeding herd. This can cause delays in payments to the syndicate contribution.

Borehole syndicates have however faced problems in as much as the further proliferation of private boreholes throughout the range and subsequent changes in herd management and land rights equally displaced older regulatory procedures. The increasing 'closing off' of common and grazing lands became a product of political and economic changes during the protectorate era and after independence. Centralization of political authority over land and water clashed with traditional forms of community organization, dissolving the subdistrict authority units. Community structures and institutions evolved and reorganized themselves using existing structures of power and control over non-privileged members of society thus showing levels of resiliency and adaptation to external pressures. Powerful members of the ruling elite in traditional communities became wealthy individuals accumulating power and capital in borehole syndicates controlling access to groundwater. The result was an increase in competition among property claims, and in terms of distribution of management authority between the user (individual herders and borehole syndicates) and the district.

According to local perspectives, syndicate membership can potentially be flexible and could even be extended to people not owning cattle (Manzungu et al. 2009). This is however in opposition with state perspective, which limits membership only to cattle owners (ibid.). The activities carried out at the local level by the borehole syndicate can also be adaptable and include non-cattle issues and double as credit clubs or burial societies. State policy is however fixated on restricting these activities only to livestock issues. Cattle production is seen by local communities as a social, cultural and economic activity whereas the state sees it only as an economic activity that should be commercialized (ibid.).

4.2 Social capital, power, and groundwater in borehole communities in Botswana

Although borehole syndicates in the Kgatlend District in southern Botswana were transparently organized around a managing committee, with regular meetings held every year and a minimum amount of members of the committee to operate (quorum), they also embodied power dynamics and an institutional and discursive duality about their purpose sustained by local elites. Borehole syndicates were developed as part of communal and tribal structures but also as enabled economic and social progress. The flexibility of customary laws allowed powerful individuals to adopt changes and promote economic change allowing borehole management structures to appear as a group form of private ownership. The chiefly elites were particularly interested in this duality as they would be able to adapt existing rules to these new structures and appropriate more exclusive rights to resources.

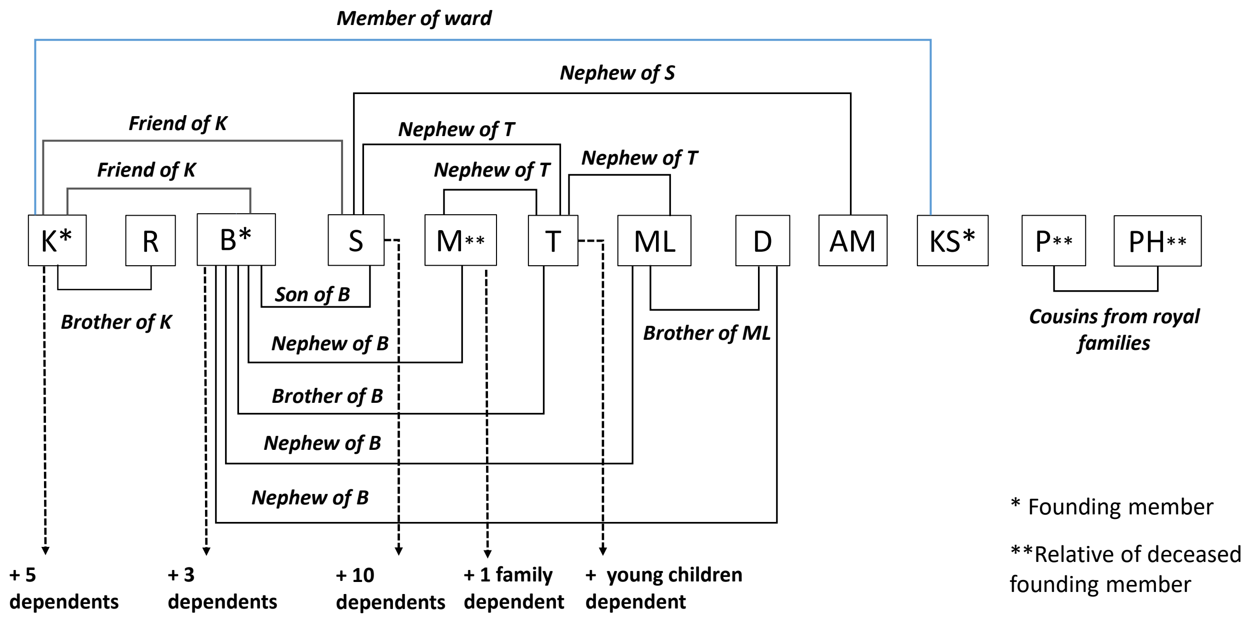
Community chiefs were also able to play with the multi-dimensional nature of the concept of community assembly, – referring at the same time to the central assembly place (court, seat of government, assembly) to each constituent of the polity at each organizational level (ward, subward, family) and to both the space and group of people meeting – and obtain an immediate collective acknowledgement of this new structure as another variation of the traditional forms of community governance. This trick also provided an extension of privilege to a wider range of community members than just the owners and syndicate members. This movement was embellished as a ‘great example of native enterprise and government cooperation’ whilst also guaranteeing financial accountability and removing an unnecessary burden on tribal funds. At the same time, borehole syndicates maintained their political and economic power by instating private property and control to the individual members of the syndicate. This new form of group ownership was also referred by the same name as the communal assemblies, thus giving it the legitimacy of a traditional community structure.

Due to the necessity to dispose of cattle and capital, chiefs and ruling elites were the ones able to invest in the borehole syndicates. Moreover, the location of boreholes drilled was based on pre-existing patterns of use of grazing and watering for cattle and benefited the chieftainship and their dependants, as boreholes would be drilled closer to the group of cattle-owners who were able to raise money for costs and repairs in the first place. This sustained their privileges and their pre-eminence into the next generation. Relatives from ruling families were the ones who benefited from training programs, education or employment around the drilling and maintenance of boreholes in the area.

The reach of influential families within the community also expanded to other areas, as powerful members became founding members of several syndicates, following a strategy of investment and accumulation with expanding herds of cattle and also in order to secure privileges for themselves and relatives (within their own borehole syndicates, Figure 6). These community members were also able to drill private boreholes in their family fields to further secure water supply for their herds. Many poorer families, however, were also incorporated in these syndicates and granted access to water and pastures, either informally as dependents paying no fees, or formally as paying members of the syndicate. This reflects traditional forms of community organization based on constructing working social compromises and alliances “based on the expectation of reciprocal benefits among persons of unequal status” (Peters 1994: 75).[12]

[12] Borehole syndicates had on average 14 formal members in the 1980s, composed of three different categories: members, dependent, and hirers. However, these members had two or three other members of the community behind him without independent rights to the borehole nor paying fees, thus extending access to the borehole for a wider proportion of the community. Borehole syndicates represent themselves as a microcosm of the traditional communal culture and practice privileging cooperation over difference. Although mutual understanding between syndicate members is supposed to be the norm, stresses linked to the financial management of boreholes (escalating prices and competition over grazing land with more and more boreholes and other users of the range) represented a major challenge to these principles of solidarity.

Figure 6. Members and relationships around a borehole syndicate founded in 1960 in Southern Botswana



Source: Authors based on information from Peters 1993.

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