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Chapter 8. Groundwater Governance in the Stampriet Transboundary Aquifer System

8.1 INTRODUCTION

Having provided a multi-level analysis of the normative framework for groundwater governance, I now present the case study of the Stampriet Transboundary Aquifer System (STAS). This layered case study analyses the normative framework applicable to the STAS at all levels including the sub-national level in a highly groundwater-dependent, semi-arid area with a range of socio-economic contexts. I examine: (1) How have groundwater governance frameworks evolved in the STAS? (2) How are hydrogeology, ecosystems services and the drivers of groundwater problems taken into account in the STAS? (3) Which groundwater governance principles have been included in the STAS governance frameworks? (4) How does legal pluralism manifest itself in the STAS? And (5) How can current designs of the STAS’ normative architecture become consistent with sustainable and inclusive development?

Drawing on different kinds of data, this chapter describes the STAS and assesses the current state of knowledge on the STAS (see 8.2), describes the evolution of groundwater governance in the STAS (see 8.3), examines the current status of the STAS governance framework through analysis of patterns in principles and how pluralism manifests both in policy and in practice (see 8.4), assesses whether these principles address the drivers of groundwater problems (see 8.5), before drawing conclusions (see 8.6). The methods for data collection and analysis have been previously discussed in Section 2.5.7.

8.2 THE STAMPRIET TRANSBOUNDARY AQUIFER SYSTEM

8.2.1 Socio-Economic Setting of the Stampriet Transboundary Aquifer System Area

STAS (see Map 8.1) is a 140,000 km\(^2\) multi-layered aquifer system underlying the groundwater-dependent ecosystem of the Kalahari Desert in Botswana, Namibia and South Africa. The predominant land uses in the STAS are (1) rural villages, settlements and communal lands, (2) wildlife conservation and management areas, and (3) agricultural and pastoral farmlands. The only urban centers are in Namibia. In South Africa, STAS falls within the Kgalagadi Transfrontier Park (KTP) (see 8.2). The STAS area includes a permanent population of nearly 50,000 people: 3,707 in Botswana, 45,049 in Namibia, and roughly 150 permanent staff living in KTP plus an additional 40,000 visitors per year to KTP on the South African side\(^{21}\) (Central Statistics Office Botswana 2014; National Statistics Agency Namibia 2012).

The STAS socio-economic landscape is diverse. Ethnic inhabitants include the Tswana, Kgalagadi and San in Botswana; the Tswana, Herero, Nama, San and Whites in Namibia; and the Meir and San in South Africa. The Kgalagadi and San are recognized indigenous peoples who are heavily disenfranchised and threatened by the loss or expropriation of their land and cultural traditions (Thondhlana et al. 2011). Further, the legacies of colonialism and apartheid have negatively impacted education, land tenure, economic development and thereby groundwater governance (see 8.3). There is limited economic activity in the STAS area. Most Botswanans and Namibians depend on agriculture for their livelihoods. Tourism is the only economic activity in the South African portion of the STAS and also occurs in Botswana and Namibia. There are no major industries or mining. Unemployment rates and average monthly incomes were 17.9\% (2010) and 4,731 Pula in Botswana (2011); 27.4\% (2012) and 5,172 Namibian dollars in Namibia (2010); and 8,193 Rand (2013) in South Africa (International Labour Organization 2015; Namibia Statistics Agency 2010).

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\(^{21}\) This is based on data collected in the field from park officials.
8.2.2 Hydrogeological Characteristics of STAS

**Geological Characteristics**

The STAS system consists of one unconfined aquifer - the Kalahari; one connected semi-confined aquifer - the Auob; and one non-recharging confined aquifer - the Nossob (Japan International Cooperation Agency et al. 2002). Full hydrogeological characterization of the STAS, including information on available volumes of water, has not been completed for any STAS country due to the lack of data (Alker 2008) and technical capacity issues. Groundwater generally flows from northwest to southeast (Japan International Cooperation Agency et al. 2002; United Nations Educational Scientific and Cultural Organization 2014) but the transboundary nature of this system is contested. While the Kalahari aquifer does not have a single, unified flow pattern and in isolation may not be considered transboundary, along the Nossob river, bordering Botswana and South Africa, one interviewee emphasized that over-pumping could have transboundary consequences. The Auob, particularly the portion on the eastern side of Namibia that crosses into South

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22 Interviewees 5, 14, 31, 34, 47, 48, 50; According to Interviewee 34 there was also there was a significant loss of data in Namibia in 2011 due to a database failure, which has impeded long-term data analysis.
23 Interviewees 14, 34, 48, 52, 55.
24 Interviewee 26.
25 Interviewee 61.
Africa and Botswana might be a flow regime with sufficient connectivity to be unitary and transboundary although this flow is difficult to trace. On the contrary, interviewees argued that the subsurface characteristics are dominated by geological heterogeneity and faulting that impedes or redirects flows, preventing them from being transboundary.

**Quality**

A large portion of the STAS is considered a “Salt Block” (United Nations Educational Scientific and Cultural Organization 2014), wherein there are high concentrations of naturally occurring salts in the groundwater. This is caused by low rainfall and high evaporation causing salts to collect in the soils. Extreme rainfall events lead to salts leaching into the aquifer, flowing in a southeasterly direction, and concentrating in the aquifer beneath southwestern Botswana and South Africa. The concentration of Total Dissolved Solids (TDS) has been recorded to be as high as 14,874 milligrams per liter (mg/l) and over 20,000 mg/l in Namibia and Botswana respectively (United Nations Educational Scientific and Cultural Organization 2014). Less than 1,200 mg/l is the WHO guideline for safe drinking water, while cattle and sheep can tolerate TDS concentrations of 4-5,000 mg/L and 5-10,000 mg/L, respectively. These quality issues sometimes limit provisioning services in the aquifer area (see Map 8.6). In locations with brackish groundwater, no alternate water sources, but with sufficient groundwater yields, small-scale desalination is a possibility for domestic supply. However, such activities could have transboundary implications if located in settlements near the Botswana-Namibia border in Ghanzi District.

**Storage and Yield**

The overall volume of groundwater stored in the STAS has not been estimated due to data limitations. As such, this discussion focuses on the potential for the different portions of the aquifer to yield groundwater for human and ecosystem uses. The Kalahari aquifer has extremely variable quality and yield, but is still significantly developed in all countries and is the only aquifer used in South Africa.

The Auob aquifer has the most significant potential yields and is the most likely to be developed for future uses. Most large Namibian towns use the Auob due to its generally good quality and high yields. As such, the rate of groundwater extraction in Namibia especially in the face of a push for food security and self-sufficiency is an issue of concern for the current president. One interviewee emphasized that the water levels were “busy lowering and lowering.” These lowering groundwater levels were observable at a dried spring in Gaochanas (see Figure 8.1) and a nearby artesian well whose water level had significantly lowered. A 2002 modeling study (Japan International Cooperation Agency et al. 2002) concluded that groundwater extraction in Namibia exceeds net recharge (recharge minus evapotranspiration). However, the assumptions underlying the model are disputed and further studies and monitoring is underway. In Botswana, given the potential availability of groundwater in the Auob layer, groundwater transfers from the STAS are pending with the recent completion of an Environmental Impact Assessment for the Masheng Transfers Project - that brings groundwater from Ghanzi district north as small cluster of villages, known as the Masheng area.

The Nossob aquifer has higher yields but low quality, and thus low development potential. However, it is used in some parts of Namibia for stock watering.

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26 Interviewee 33.
27 Interviewee 26.
28 Interviewee 17, 33, 39, 52.
29 Interviewee 21.
30 Interviewee 61.
31 Interviewee 25.
Flow and Pressure

The three layers of the STAS receive recharge through different mechanisms (see Map 8.2, Map 8.3, and Map 8.4 for areas of groundwater recharge, discharge and availability). The uppermost Kalahari aquifer primarily receives recharge from rainfall with small contributions from the overlying ephemeral Auob and Nossob rivers.
Map 8.2 Groundwater Availability in the Kalahari (Upper Layer) of the STAS

Legend
- Country Border
- Stampriet Boundary

Population
(number of people)
- 173 - 500
- 501 - 1000
- 1001 - 2000
- 2001 - 3000
- 3001 - 4500
- No Population Data

Uppermost Layer - Kalahari
Areas Yielding Groundwater (m³/hour)
- 0 - 10
- 10 - 20
- 20 - 60

Intermediary Layer - Auob
No Population Data Available

Population

Legend

Map 8.3. Groundwater Availability in the Auob (Intermediate Layer) of the STAS
Map 8.4 Groundwater Availability in the Nassob (Lower Layer) of the STAS

Legend
- Country Border
- Stampriet Boundary

Population (number of people)
- 173 - 500
- 501 - 1000
- 1001 - 2000
- 2001 - 3000
- 3001 - 4500
- No Population Data Available

Lowermost Layer - Nassob
Areas Yielding Groundwater (m³/hour)
- 0 - 10
- >10

Map 8.5 Groundwater Recharge and Discharge Areas of the STAS
Map 8.6 Groundwater Unsuitable for Human and Livestock Consumption in the Stampriet Transboundary Aquifer System

Legend
- Country Border
- Stampriet Boundary
- Population (number of people)
  - 173 - 500
  - 501 - 1000
  - 1001 - 2000
  - 2001 - 3000
  - 3001 - 4500
  - No Population Data
- Groundwater Unsuitable for Human Consumption
  - Uppermost Layer - Kalahari
  - Intermediate Layer -
  - Lowermost Layer - Nassob
- Groundwater Unsuitable for Livestock Consumption
  - Uppermost Layer - Kalahari
  - Lowermost Layer - Nassob

noticeably experienced by local water users, hundreds of kilometers away from the recharge areas.\textsuperscript{32} However, several local users reported long-term declines, disappearance of spring discharge and reductions in artesian pressure.\textsuperscript{33} However, due to climate variability, it is questionable whether the major rainfall events, upon which Auob recharge relies, will still occur.\textsuperscript{34} The Nassob aquifer only receives negligible recharge from the Auob and therefore contains fossil groundwater (Japan International Cooperation Agency et al. 2002). The Auob and Nossob aquifers are also artesian (i.e. pressurized, see 3.3.3). Consequently, groundwater spouts to heights of up to 8m above ground when wells are sunk into these aquifers. In some locations, this pressure also pushes a large volume of recharge up into the Kalahari from the Auob aquifer below, through a process called ‘leakage.’\textsuperscript{35}

While recharge mechanisms are fairly well understood, losses and discharges from the system have yet to be quantified definitively (United Nations Educational Scientific and Cultural Organization 2014). This is of concern as the long-term water balance of the aquifer is potentially in the negative. After the 2002 investigation of the Namibian portion of the aquifer, JICA et al. (2002) estimated significant losses due to evapotranspiration as 83\% of rainfall evaporates, 14\% is transpired by vegetation, 2\% is runoff, and 1\% is recharged.\textsuperscript{36} However, “if the water table is below 15 meters, evapotranspiration is not the issue,”\textsuperscript{37} but possibly leakage from decrepit wells,\textsuperscript{38} which is a more serious threat “than over-abstraction due to irrigation.”\textsuperscript{39}

\section*{8.2.3 Ecosystems Services of the STAS}

\textbf{Provisioning and Cultural Services}

STAS groundwater’s provisioning services include supply for basic human needs, tourism, and commercial agriculture. Local authorities contract with the parastatal Water Utilities Corporation in Botswana and the parastatal NamWater in Namibia for town and village water supplies through a combination of household connections and community water points. Solid wastes and wastewater is collected by local authorities and disposed on village and town outskirts. In the communal lands of Namibia, there are significant populations that lack sanitation and practice open defecation in the ‘bush’.

Commercial agriculture is the STAS’ largest provisioning service. In Namibia, groundwater supplies approximately 2,000 commercial farms and 160 small scale farms with a total of 550 hectares under irrigation (Alker 2008). The three main crops grown are lucerne (48\%), vegetables (18\%) and maize (17\%) mostly for domestic use, but also for export to South Africa and Angola. Both Namibia and Botswana have large livestock industries with twice as many cattle and sheep than humans, serving domestic, SADC and European export markets with the latter receiving the best quality meat.

Groundwater in the STAS area is linked to both provisioning and cultural services through tourism. There are numerous guest lodges as well as public and private game reserves, the largest of which is KTP. In private game reserves, groundwater may come through municipal systems or private boreholes. In KTP, groundwater is supplied by the Motswanan and South African departments of environment. They rely predominantly on the Kalahari aquifer although there are problems with yield and the TDS exceeds drinking water quality

\begin{footnotesize}
\begin{itemize}
\item\textsuperscript{32} Interviewees 8, 25, 46.
\item\textsuperscript{33} Interviewees 23, 26,46.
\item\textsuperscript{34} Interviewee 52.
\item\textsuperscript{35} Interviewee 26, 46.
\item\textsuperscript{36} Interviewee 17.
\item\textsuperscript{37} Interviewee 61.
\item\textsuperscript{38} Interviewees 26, 40, 46.
\item\textsuperscript{39} Interviewee 26.
\end{itemize}
\end{footnotesize}
standards. Consequently, groundwater is used for bathing and hygiene and bottled water for drinking and cooking.

**Regulating and Supporting Services**

The STAS provides the regulating services of carbon sequestration, nutrient cycling, pollutant attenuation and its groundwater also stabilizes the Kalahari dunes. STAS provides supporting services to numerous groundwater-dependent flora and fauna species. Table 8.1 indicates whether these species require flowing water (and live in locations with springs, pans, or watering holes), can survive without flowing water depending instead on wild watermelon, tubers and other water-rich plants and highlights their interaction with groundwater resources. Several of the animal species attract tourists.

The plant species support basic human needs by providing wood for shelter, medicine and fuel; serve as indicators of proper land use and land management; and may be internationally-traded genetic /biological resources. For example, the Hoodia and Devil’s Claw plant species are used for medicinal purposes by several tribes including the indigenous Khomani San people. The knowledge required to convert these plants into medicines is also the subject of intellectual property challenges as the resulting products are increasingly imported to Europe for the purposes of weight loss and diabetes control.

### Table 8.1 Groundwater-dependency of Species in the STAS

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>ORIGIN</th>
<th>NEEDS FLOWING WATER</th>
<th>EFFECT ON GROUNDWATER RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acacia Tree</td>
<td>Native</td>
<td>No</td>
<td>Reduction via Evapotranspiration</td>
</tr>
<tr>
<td>Blue Wildebeest</td>
<td>Native</td>
<td>Yes</td>
<td>Negligible</td>
</tr>
<tr>
<td>Camel Thorn Tree</td>
<td>Native</td>
<td>No</td>
<td>Reduction via Evapotranspiration</td>
</tr>
<tr>
<td>Devil’s Claw</td>
<td>Native</td>
<td>No</td>
<td>Reduction via Evapotranspiration</td>
</tr>
<tr>
<td>Gemsbok</td>
<td>Native</td>
<td>No</td>
<td>Negligible</td>
</tr>
<tr>
<td>Giraffe</td>
<td>Native</td>
<td>No</td>
<td>Negligible</td>
</tr>
<tr>
<td>Hoodia</td>
<td>Native</td>
<td>No</td>
<td>Reduction via Evapotranspiration</td>
</tr>
<tr>
<td>Lion</td>
<td>Native</td>
<td>No</td>
<td>Negligible</td>
</tr>
<tr>
<td>Prosopis (Mesquite) Tree</td>
<td>Invasive</td>
<td>No</td>
<td>Significant Reduction via Evapotranspiration</td>
</tr>
<tr>
<td>Springbok</td>
<td>Native</td>
<td>No</td>
<td>Negligible</td>
</tr>
<tr>
<td>Shrubs (various species)</td>
<td>Native &amp; Invasive</td>
<td>No</td>
<td>Reduction via Evapotranspiration</td>
</tr>
</tbody>
</table>

8.2.4 **Drivers of Groundwater Problems in STAS**

Table 8.2 presents the drivers of groundwater problems in the STAS, which are further elaborated below. Since the STAS is a multi-layered aquifer system with each layer possessing different characteristics, some drivers of groundwater problems in the STAS are discussed from both the perspective of the whole aquifer system, while others are most relevant to specific layers. As such, I will discuss the drivers at each geographic level and highlight whether it is relevant to the whole system or a particular layer.

At the global level, climate change is expected to reduce the frequency of recharge events, affecting the whole STAS but especially the Auob layer that relies on periodic flooding events for recharge (see 0). Longer time spans between recharge events could potentially increase the salinity of the groundwater as well. International trade and economy would mostly affect the upper two layers of the system, potentially resulting in depletion. The Kalahari layer is affected by trade in medicinal products and livestock grazing practices. Unfortunately, overgrazing of livestock for commercial purposes is threatening native species by making land more susceptible to infestation by invasive and pioneer species, a phenomenon called ‘bush encroachment’. In particular, the thirsty Prosopis is observed to have noticeable effects on shallow groundwater levels. The Auob is used to irrigate agricultural products that are traded internationally as well as to produce stock feed for the cattle industry. Since, the Nassob is very deep and, in many locations so saline that 52% is unsuitable for livestock, it is less likely to be affected by this driver.
### Table 8.2 Drivers of groundwater problems in the STAS

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>DRIVERS</th>
<th>CONSEQUENCE IN STAS REGION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global</td>
<td>Climate Change →</td>
<td>Fewer recharge events</td>
</tr>
<tr>
<td></td>
<td>International trade/Economy →</td>
<td>Trade in agricultural products causing water withdrawal</td>
</tr>
<tr>
<td>Regional - Transboundary</td>
<td>Regional agricultural trade →</td>
<td>Schemes promoting/enhancing agricultural production</td>
</tr>
<tr>
<td></td>
<td>Spread/migration of flora and fauna →</td>
<td>Spread of invasive species; wildlife tourism and hunting; trade in medicinal plants</td>
</tr>
<tr>
<td></td>
<td>History of colonization/ apartheid legacy →</td>
<td>Outdated groundwater law in Botswana and Namibia; disparate education levels; language barriers; land tenure inequities</td>
</tr>
<tr>
<td>National</td>
<td>Pumping and pollution by individuals, local authorities, and commercial agriculture →</td>
<td>Localized groundwater depletion and pollution</td>
</tr>
<tr>
<td></td>
<td>Natural changes in groundwater quality and quantity →</td>
<td>Reduced access to potable water and/or water of sufficient quality for irrigation</td>
</tr>
<tr>
<td></td>
<td>Population growth/urbanization in Namibia and Botswana →</td>
<td>Increased demand for potable water/sanitation services and food</td>
</tr>
<tr>
<td></td>
<td>Food security policy – especially Namibia →</td>
<td>Expansion of commercial agriculture</td>
</tr>
<tr>
<td></td>
<td>Development policy →</td>
<td>Groundwater allocation for economic/subsistence activities</td>
</tr>
<tr>
<td></td>
<td>Tourism policy – especially South Africa →</td>
<td>Allocation of groundwater for wildlife parks/guest houses</td>
</tr>
<tr>
<td></td>
<td>Energy policy →</td>
<td>Ability to pump groundwater</td>
</tr>
<tr>
<td></td>
<td>Forestry policy →</td>
<td>Removal or persistence of invasive species</td>
</tr>
<tr>
<td></td>
<td>Land use strategies →</td>
<td>Protection of endemic species</td>
</tr>
<tr>
<td>Subnational</td>
<td>Land rights →</td>
<td>Improper facility citing in vulnerable groundwater zones</td>
</tr>
<tr>
<td></td>
<td>Grazing and land management practices →</td>
<td>Water services and sanitation systems or lack thereof</td>
</tr>
<tr>
<td></td>
<td>Customary practices and indigenous knowledge →</td>
<td>Localized pollution and depletion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Small-scale cultural uses; challenges to current access and allocation regimes</td>
</tr>
</tbody>
</table>

At the regional transboundary level, regional agriculture and trade would have similar consequences for the STAS as would international trade. The spread and migration of flora and fauna across the region has two main consequences. The first is the proliferation of invasive species, which consume large amounts of groundwater from the Kalahari layer. The second is a large and growing wildlife tourism industry that drives increased, localized consumption of groundwater used for luring animals to artificial watering holes and supplying guest facilities in parks. The shared colonial history and apartheid legacy affects the whole STAS and has resulted in outdated legal frameworks in Botswana and Namibia as well as issues of disparate education levels, language barriers, and land tenure inequity in all countries.\(^{40}\) This makes engaging the public in conservation efforts and giving equitable access to water and sanitation difficult. The communities have difficulties requesting assistance and support from regulators, while regulators struggle to educate people regarding reporting requirements and appropriate water and land management practices.\(^{41}\)

At the national level, pumping and pollution by individuals, local authorities and agriculture are or could be major drivers of groundwater problems in the STAS, especially the Kalahari and Auob layers (see 8.2.4). The other drivers exacerbate the potential depletion problems already being experienced. Population growth and migration as well as the various non-water policies that would nevertheless rely on groundwater for their implementation (e.g. food security, energy, development, forestry, and tourism) would incentivize or require activities that would pump and/or pollute groundwater unless carefully designed. For example, the increasing

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\(^{40}\) Interviewees 15, 17, 18, 21, 47, 60.

\(^{41}\) Interviewees 1, 3, 4, 27, 31, 55.
need for food security and implementation of the Green Schemes Programme in Namibia will undoubtedly affect groundwater use and requires careful coordination in order to ensure there is sufficient water to meet this objective. The land use strategies, including grazing and land management practices, lead to localized contamination from improperly sited stock watering facilities, unlined solid waste and sanitation facilities, poor pump maintenance practices, and the uncontrolled spread of groundwater-dependent invasive species. Natural changes in groundwater quality and quantity, may be potentially exacerbated by climate change, and reduce availability for these activities further straining the STAS.

At the subnational level, the drivers present at the other levels manifest themselves on the ground. The land rights inequities translate into desperate access to water and sanitation systems. Agricultural practices, especially among subsistence farmers, often result in overgrazing that facilitates the spread of invasive species and groundwater depletion. Local land use strategies result in poorly sited waste and sanitation facilities, causing pollution. Customary practices and indigenous knowledge are in tension with access and allocation regimes. In KTP, the outdated wastewater treatment system in KTP, which currently consists of either septic tanks or oxidation ponds, is facing increased risk of contamination as the system approaches its maximum capacity.

8.3 **EVOLUTION OF THE STAMPRIET GOVERNANCE FRAMEWORK**

8.3.1 **Overview of the Stampriet Governance Framework**

Groundwater governance in the STAS countries in the pre-colonial era is not well documented. However, ‘traditional’ methods of acquiring the water necessary for human survival in the Kalahari are still used today. These methods include construction of hand-dug shallow wells, consumption of water-rich plants and roots, water divining and sucking water from saturated sand through straws made of reeds. Norms linked to these processes are not described in the available literature. During the colonial era in Namibia and South Africa, rules on land tenure, irrigation and mining were developed in favor of the British, Dutch, and German colonists who moved the indigenous people away from prime lands (Swatuk 2010). In South Africa and Namibia (then Southwest Africa), irrigation boards were created in 1926 to reduce competition among white farmers for water resources, while black populations were excluded from such infrastructure and management arrangements (Kemerink et al. 2013). Colonization influenced Botswana indirectly beginning in 1885. With the encroachment of Boer settlers into the territory of the Kalahari tribes, tribal leaders requested protection from the British government to prevent conflict. Under the British protectorate, many water supply boreholes were drilled in the STAS area.

South Africa’s support of the allied forces in World War II resulted in huge economic growth, of which white Afrikaners sought to take advantage. Consequently, in 1948, the apartheid regime was formed and enforced in South Africa and what is present-day Namibia. During apartheid, (ground)water and land rights were linked under riparian and prior appropriation rights regimes. The 1956 Water Act empowered the state to increase its control over public water resources, forming such concepts as the ‘ecological reserve’ to prevent water from “being grabbed every which way.” While the ecological reserve supported ecosystems, it did so by expropriating the customary rights of water users (Kemerink et al. 2011; Swatuk 2008). Swatuk (2010: 526) says “the human and physical geographies of apartheid reflect the presence or absence of water, as well as its capture and the uses to which it was put.” Segregated education systems trained the black population

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42 Interviewees 4, 5, 6, 21, 26, 27.
43 Interviewee 5, 20, 35.
44 Interviewees 31, 42.
45 Interviewee 55.
46 Interviewee 60.
47 Interviewee 60.
for manual labor in mines and farms rather than liberal arts and sciences (Kemerink et al. 2011). These inequities still leave their mark on local (ground)water governance.

In 1967 Botswana gained independence and colonial boreholes were either taken over by the Water Utilities Corporation or given to local communities. Those given to communities are not subject to the current rights and permits regime. Yet, the country is still governed by the Water Law from 1968 and the colonial Borehole Act of 1956 has not been modified to include key principles required for comprehensive monitoring and management of groundwater resources. Namibia simultaneously gained independence from South Africa and its apartheid regime in 1990, but continues to rely upon the colonial 1956 South African Water Act to govern its water management today. As of December 2016, Namibia is still working towards adopting its 2013 National Water Act. Although it has been gazetted, it has not entered into force because the requisite implementing policies have not yet been drafted and approved. South Africa gained independence in 1994 and its 1998 Water Act is recognized as one of the most comprehensive water laws in the world, aligned with global best practice and capitalizing on international legitimacy (Swatuk 2008). Under the provisions of the Act, South Africa is moving away from riparian rights systems by decoupling land tenure from water and this considered a strong starting point for redressing past race and gender inequities (Kemerink et al. 2011; van Koppen and Jha 2005). After Namibia’s independence, the country underwent a similar transition out of the riparian rights systems by decoupling land and water rights, although the colonial water law still governed water resources management.

The land reform processes in Namibia and South Africa required both governments to repossess all land in their territories and then redistribute private, communal and tribal lands. In both countries, the main objective of the land reforms is redress, poverty alleviation and improved well-being for those discriminated against and disposed during apartheid and colonization (Falk et al. 2017). The reform process required the governments to purchase land from private owners, including freehold farms, requiring millions in investments from the governments. In Namibia, a first right of refusal policy has been implemented. Thus, as farmers sell their lands, the government has the first opportunity to buy it for redistribution or to let it sell on the open market. This approach resulted in about 28% of its commercial farm lands being redistributed as of the beginning of 2016 (Phillips 2016). However, full land tenure reform has not taken place because, large tracts of land falling under customary tenure have not been subject to the reforms (Werner 2001). South Africa’s initial goal was to achieve restitution, redistribution or tenure reform in 30% of agricultural lands by 2004, 10 years after the process began (Cousins 2007). However, they faced challenges due to their policy of acquiring land at market value. While market-value land acquisitions sound politically appealing, between 1994 and 2004, land reform received less than 1% of the national budget. Yet the actual costs were significantly higher, resulting in slow progress (Swatuk 2010). By 2004 only 4.2% of agricultural land had undergone reform; thus the 30% goal was pushed back to 2014 and the budget was increased to around 1% (Cousins 2007). Yet, by 2014 still only 8% of land had been redistributed (McCusker et al. 2015).

An additional consequence of land reform is that water rights, which previously were linked to the land, must also be reorganized (Kemerink et al. 2011; Swatuk 2010). As such, the countries developed licensing and permitting regimes and also adopted the human right to water (see 8.3.2). Nevertheless, all three countries’ water governance activities focus on surface water, “even though it is nowhere to be found,”50 in the STAS area. Botswana and Namibia are most clearly grappling with this disconnect in understanding how to implement the legal norm of using the basin as the management unit where an aquifer based or administrative boundary approach might be more suitable.51
Despite these shifts in governance, there are still challenges. In Botswana, stakeholders see the legal instruments as inadequate and outdated.\textsuperscript{52} In Namibia and South Africa, although ‘water controls’ in favor of the whites were well implemented and enforced under the apartheid regime,\textsuperscript{53} replacing these with more equitable principles has been difficult, being slowly implemented and poorly enforced. A lack of professional capacitati on at the national level combined with a lack of access to education for black people during apartheid, has contributed to a lack of political will from national to local level and to intellectual capital for groundwater governance in villages being ignored (Schreiner 2013).\textsuperscript{54} Nevertheless, all three countries have made recent efforts to capture indigenous knowledge systems.\textsuperscript{55} Further in 2013, the STAS partnered with donor agencies to address these key issues directly through a project called “Groundwater Resources Governance in Transboundary Aquifers (GGRETA).”

8.3.2 Current Status of Governance Instruments Relevant for the STAS

Global and Regional-transboundary Level Laws, Policies and Programs

This section discusses the global (see also 5.2), regional-transboundary governance frameworks and principles (see also 6.2) relevant to groundwater resources for the STAS riparians.\textsuperscript{56}

At the global level, the UNECE Water Convention (1992), the UN Watercourses Convention (1997), and the ILC Draft Articles (2002) are the groundwater-specific governance instruments relevant to the STAS. Namibia and South Africa are party to the UN Watercourses Convention. This shows that the STAS Aquifer states have accepted normative obligations related to groundwater governance, including but not limited to the obligation to cooperate and govern groundwater peacefully, equitably and in accordance with reasonable utilization of groundwater, protection and preservation of ecosystems related to groundwater, and pollution prevention for groundwater resources. All three countries could potentially accede to the UNECE Water Convention and/or the ILC Draft Articles if the latter eventually becomes a formal legal instrument. The Stampriet Aquifer states are also party to the Ramsar Convention (1972), the UNFCCC (1992), and the UNCCD (1994).

The relevant bilateral agreements include the 2000 Bilateral Agreement between Botswana and South Africa on the Recognition of the Kgalagadi Transfrontier Park and the 1992 Joint Permanent Water Commission to deal with matters relating to the Okavango River, Kwando-Linyanti-Chobe river system, and select transboundary groundwater resources between Botswana and Namibia. The 2000 Agreement establishing a Permanent Water Commission between Namibia and South Africa was originally scoped specifically to address issues involving the management of the Lower Orange River and has since been expanded to include some adjacent ephemeral rivers. Transboundary groundwater resources were not explicitly included in the scope of the agreement, as both countries implicitly understood that groundwater falls within the Commission's purview (Alker 2008). Regional and transboundary (ground)water specific agreements of the STAS countries include the Africa Convention on the Conservation of Nature (2003; also see 6.4), the Revised SADC Protocol (2000), and the Orange-Senqu River Basin Agreement (2000). The Revised SADC Protocol is legally binding on all three STAS states. It is holistic in terms of issue coverage but only includes groundwater in accordance to the definition of a watercourse as defined in the 1997 UN Watercourses Convention. The Orange-Senqu

\textsuperscript{52} Interviewees 5, 19, 27.
\textsuperscript{53} Interviewee 60.
\textsuperscript{54} Interviewees 17, 18, 31.
\textsuperscript{55} Interviewee 27.
\textsuperscript{56} As discussed in Section 1.3, all norms relevant to groundwater governance will be evaluated regardless of whether or not they are legally binding as they all contribute to the normative architecture.
Agreement, a basin-specific “implementation arrangement” under Article 5 of the SADC protocol,\textsuperscript{57} is also legally binding and includes a fourth party Lesotho, and creates a technical advisory committee to the participating states.\textsuperscript{58} Regional groundwater-specific initiatives have been slow and mainly donor driven although this might shift with the establishment of the SADC Groundwater Management Institute.\textsuperscript{59}

A key transboundary program focus in groundwater is the Swiss Agency for Development and Cooperation and UNESCO project entitled “Groundwater Resources Governance in Transboundary Aquifers (GGRETA),” which sought to directly address and improve the groundwater governance challenges. The GGRETA project aims to ‘enhance cooperation on water security, reduce transboundary and water-use conflicts, and improve overall environmental sustainability.’ Phase I of the project (2013-2015) conducted a detailed assessment with the objective of enhancing technical knowledge and capacity of the STAS countries; building trust through joint fact finding and data sharing; assessing areas of transboundary concern through diagnostics analysis; and understanding the hydrogeological, environmental, socio-economic, governance, as well as legal and institutional setting of the STAS. A key component that began in Phase I and is being developed in earnest in Phase II (2016-2018) is the establishment of a cooperation mechanism for transboundary groundwater management.

\textit{National-Level Laws and Policies}

\textbf{Botswana}

Key national laws and policies in Botswana that are directly and indirectly relevant to groundwater resources include the National Water Act (1968, rev. 2008), the National Boreholes Act (1956), the National Water Master Plan Review (2006), the National Integrated Water Resources Management & Water Efficiency Plan (2013), and the National Water Conservation Strategy (1999). The Botswana National Water Act aims at water allocation and distribution, and lists conditions for obtaining and maintaining rights. The Act defines public waters to include “all underground water made available by means of works.” Groundwater that used solely for minerals extraction or that is not accessible via infrastructure is not considered in the public domain. Further, property rights and water rights are separated in the Act. Subsistence uses of public groundwater such as watering livestock, and domestic activities do not require a right or permit. Wells and boreholes may also be sunk or deepened without a permit, if it is done for the purpose of wildlife conservation. A permit is required for abstraction, use, diversion, damming, storage and effluent discharge. The Act establishes a Water Apportionment Board that oversees implementation of the Act and other relevant international agreements. A Water Registrar is also established as the ex officio Secretary of the Board and the enforcement body.

The Borehole Act stipulates that contractors are allowed to sink boreholes. Those sinking boreholes deeper than 15 meters must notify the director of the Geologic Survey of Botswana, who may also inspect the borehole during or within a year of construction. If the borehole is located in tribal territories the relevant district council must also be notified.

The various national plans emphasize different aspects of water governance in Botswana. The Water Master Plan focuses on development potential. It evaluates options such as infrastructure development (including drilling additional boreholes), water transfer schemes, and enhanced technologies to assess and utilize groundwater resources. The Integrated Water Resources Management and Water Efficiency Plan addresses integrated planning. It highlights several implementation areas including the efficiency of water allocation; water supply and demand management; integration of water and land use planning; using a catchment area management approach; management of shared water resources; institutional capacity building; stakeholder

\textsuperscript{57} Interviewee 50.
\textsuperscript{58} Interviewee 12.
\textsuperscript{59} Interviewees 9, 12, 14, 29, 50.
participation; pollution prevention and control; and accounting for ecological needs. The Water Conservation Strategy focuses on demand management through water pricing and economic valuation, technical measures and efficiency practices, and public awareness and education.

The responsibilities for water management in Botswana are distributed across several entities including the Department of Water Affairs (B-DWA), the Department of Geological Surveys, the Ministry of Agriculture, the Ministry of Natural Resources, Ministry of Minerals, Energy and Water Affairs, and the Ministry of Local Government, Lands and Housing. The Ministry of Minerals, Energy and Water Affairs is responsible for implementing the Water Resources Act, the Boreholes Act, the National Water Policy, and overseeing the Water Utilities Cooperation, which is responsible for potable water supply to urban centers and mines. It also houses the International Water Unit, which provides technical support for management of shared waters. The Ministry of Local Government, Lands and Housing oversees water supply to rural areas and the Department of Water Affairs conducts ad hoc field inspections. Nevertheless, coordination and communication between responsible agencies remains a challenge and are exacerbated in the STAS area by an absence of user-based organizations and public engagement.

**Namibia**

In 2016, Namibia was transitioning between using the 1956 South African Water Act and the 2013 Namibia Water Resources Management Act. Although the 2013 Act was adopted in 2013, it is not yet “in force” as it contains multiple references to implementing policies, which do not yet exist. The policy drafting process is underway and still has not been completed as of December 2016. Until this time, Namibian officials implement the 1956 South African Water Act, which was based on riparian and prior appropriation rights regimes. It links water and property rights thereby privileging land owners. Further, it does not include any of the modern social, ecological, political or economic principles (e.g. public participation, cost recovery) nor does it address IWRM or include strong enforcement powers. The 2013 Water Resources Management Act aims to manage and conserve all water resources, including the whole or any part of an aquifer through fundamental principles and institutional structures. The principles require preparation of an Integrated Water Resources Management Plan; a licensing regime for abstraction, discharge, and waste disposal; and protected areas where there may be significant risk of depletion, contamination or extinction of species, including the protection of wetlands. The Act empowers the Water Minister to delegate powers to the Water Regulator (Department of Water Resources) and basin management committees; establishes a Water Advisory Council and Water Tribunal for public consultation and enforcement, respectively; and Water Point Committees and local water committees for management in rural areas.

Other relevant laws and policies include the Water Supply and Sanitation Policy (2008), the National Water Policy White Paper (2000), the National Drought Policy and Strategy (1997), and the National Agriculture Policy (1995). The Water Supply and Sanitation Policy and the National Water Policy White Paper will both be superseded by new policies implemented under the 2013 Act. These policy documents emphasize water and sanitation services, equitable and sustainable management, and drought risk management. The Water Supply and Sanitation Policy creates the Directorate of Water Supply and Sanitation Coordination and requires water services providers to also provide sanitation services. Foreseeing an increase in demand due to implementation of national development policies, it prioritizes water for domestic use, encourages stakeholder participation, emphasizes cost recovery, and sets out basic policy principles. The National Water Policy White Paper sets guiding policy principles and strategic objectives for resource assessment, shared watercourses, water use and conservation, economics and finance, legislation, community participation, and capacity building. Given, that aridity and drought are ‘normal phenomenon’ in Namibia, the National Drought Policy and Strategy aims to shift drought risk management responsibilities away from the

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60 Interviewees 12, 34, 43, 62.
61 Interviewee 12.
62 Interviewee 62.
government and towards the farmers by way of measures which are geared towards on-farm risk
management. According to the policy, financial assistance and food security interventions only occur in
extreme or ‘disaster’ drought scenarios. This is set out in alignment with the National Agriculture Policy
which aims to increase and stabilize farm income and productivity in order to ensure food security, generate
livelihood and employment opportunities in rural areas, increase investment in agriculture, promote
sustainable land and resource use and contribute to rural and regional development, among others. Further it
calls for cooperation between the farming community and private sector in achieving these goals.

All groundwater resource development projects are overseen by the Geohydrology Division of the
Department of Water Affairs and Forestry for Namibia (N-DWAF). N-DWAF lies within the Namibian
Ministry of Agriculture, Water and Forestry. N-DWAF monitors groundwater levels in the STAS and
provides technical capacity to the drilling industry and farmers upon request. The Basin Management
Committees, which are created for surface water management, engage with users. Due to specific concerns
regarding over-abstraction in the STAS, local uses and the government formed the Stampriet Basin Water
Committee to assist N-DWAF in monitoring the aquifer. In principle, the Committee and N-DWAF should
consult regarding applications for wells. The Committee should also update N-DWAF on a range of issues
including extraction rates, illegal drilling, poor condition of wells, and wasteful or non-beneficial uses.
However, this committee has not been active in recent years. The Stampriet Farmers Association, which is
active in the commercial farming areas around the towns of Stampriet and Mariental, also encourages farmers
to report groundwater use to N-DWAF.

The enforcement of groundwater related laws and policies is primarily achieved through cooperation with
users through water users’ associations and review of permits for abstraction (Alker 2008). There are no
observed cases of suspension or termination of permits. N-DWAF and the Geohydrology Division record
permit processing and water quality information gathered from monitoring and ‘spot checks.’ According to
Namibian officials, there are no records related to punishments for violation of groundwater permits, possibly
because a rectification process typically precedes punitive action.

South Africa

Management Strategy for the Water Services Sector (2004), National Groundwater Strategy (2010), Artificial
Recharge Strategy (2007), and the Policy and Strategy for Groundwater Quality Management (2000) are the
key water laws and policies relevant to groundwater. The Water Act designates groundwater as part of the
public domain and ensures the conservation and development of all water resources. In doing so, the Act
promotes equitable access; requires efficient, sustainable and beneficial use; facilitates social and economic
development; protects ecosystems and reserves quantities of water for their use; implements the human right
to water; redresses ‘the results of past racial and gender discrimination;’ and honors international obligations.

From an institutional perspective, the Act lays out the responsibilities of the Water Minister; establishes
catchment management agencies, water users associations, advisory committees, and a water tribunal. The
Act articulates general principles for water governance; provides measures for quantitative and qualitative
protection; requires licensing of non-subsistence uses; delineates rights of access to land; and stipulates
requirements for monitoring, assessment and information systems.

The Water Services Act and Geosciences Act regulate water supply and sanitation services provision
(including tariffs and providers) and authorize and manage data collection for (hydro)geological exploration
respectively.

The Water Resource Strategy aims at ‘managing water resources to ensure that water is used to support
equitable and sustainable social and economic transformation and development.’ It accomplishes this through
the decentralization of responsibilities to catchment agencies and water users’ association. The Plan also
proposes specific strategies for resource protection; water use, conservation and demand management; water
pricing; establishing monitoring and information systems; and disaster risk management. The Water Conservation and Demand Management Strategy for the Water Services Sector promotes water use efficiency and equitable allocation through environmental protection; fostering a culture of conservation and demand management among providers, users and consumers; and promoting integrated planning and capacity building.

The National Groundwater Strategy is currently used to guide internal policy-making within the South African government. It aims to enhance recognition of groundwater as an important, strategic water resource; ground it within an integrated management approach; increase knowledge and capacity with regards to groundwater management; and develop and implement better groundwater management programs. The Groundwater Strategy has focal areas including the regulatory environment, resource planning, human and institutional capacity; research and information management; and communication and awareness.

The Artificial Recharge Strategy aims to use subsurface water storage as part of IWRM in South Africa to contribute to the use and availability of water resources. The Policy and Strategy for Groundwater Quality Management’s objective is integrated and sustainable management of groundwater quality in order to protect groundwater resources and provide a secure water supply. The strategy aims to (a) implement ‘source-directed’ controls, imposing regulatory controls, and providing incentives to protect water quality; (b) manage impacts for protection of the water reserve and assurance of beneficial uses; and (c) remediate groundwater quality where feasible. It enhances understanding of the vulnerabilities of groundwater to pollution; relationship between quality and polluting practices; land use regulation; and controlling polluting activities and aggregate impacts of these practices.

The Department of Water and Sanitation (SA-DWS) implements the Water Act, monitors all water resources, and contributes to the development of the national water strategy. Under the SA Water Act, the nine Catchment Management Agencies of South Africa will gradually subsume SA-DWS’ functions. These functions include planning, implementation and coordination of all water-related activities as well as public engagement. Certain aspects of implementation remain challenging in South Africa, as the formation of Catchment Management Agencies has been slow. Further, the evaluation of groundwater resources for the purpose of allocation and reserve has also presented challenges. The Lower Orange catchment agency has jurisdiction in the STAS area but is considered a low priority area and thus a Catchment Management Agency has not been formed and the reserve has not been calculated. Therefore, it is anticipated that the primary responsibilities will remain with SA-DWS for the foreseeable future. There is clear evidence of implementation of the licensing regime through records of water use licenses that have been granted, renewed, terminated or suspended. Further, warnings (called directives) are issued in cases of non-compliance.

Subnational Governance Architecture

Botswana

In Botswana, at the district level, the Ghanzi and Kgalagadi Districts Councils oversee and approve activities of authorities such as the Department of Water Affairs (DWA), Water Utilities Corporation (WUC), Land Board, Department of Environment and Department of Agriculture. In Ghanzi, these authorities and others are part of an interdepartmental Land Use Planning Committee that makes recommendations to the District Council regarding proposed projects and initiatives.63

In villages and settlements within the STAS area, the most relevant actors in groundwater governance include the WUC borehole operators, borehole syndicates and farmers associations, where relevant (UNESCO 2016). The borehole operators manage the well(s), pump(s), and water tanks for domestic water supply; ensure operation of the main distribution network, water meters and service points; and provide education as deemed

63 Interviewee 28, 31.
necessary by the WUC. Borehole syndicates and farmers associations manage community wells that have been installed either by the communities themselves or the DWA. Borehole syndicates are typically for domestic supply and subsistence agriculture, while farmers’ associations are for livestock watering. Both entities are composed of elected officials who are responsible for maintaining the infrastructure, collecting payment for uses, and observing changes in quality and/or yield. There is one active farmers association in the Ghanzi district, but no borehole syndicates. In Kule, it was also reported that subsistence cattle farmers will also informally manage and cooperate in order to supply water for cattle. It is unknown if these entities or practices exist in the communal lands of the Kgalagadi District.

**Namibia**

The STAS area in Namibia covers four districts including Karas, Hardap, Khomas, and Omaheke. District-level authorities have limited influence. Groundwater governance remains either centralized or at the community level. There are Water Point Committees in the rural parts of the STAS that manage and control water provided through the Department of Water Affairs and Forestry Infrastructure. The Water Point Committees are mainly engaged in maintenance, control of water access and collection of water use fees. Areas that receive water supply via NamWater, have supply infrastructure and water services payments overseen by a borehole operator. However, some people located in the official service area may not be able to afford a connection to the distribution network and therefore may rely on springs, or supply from neighbors. There is at least one active farmers association in the STAS. While it does not take on any groundwater management functions, the member expressed concern regarding falling groundwater levels to the Department of Water Affairs in a June 2015 meeting.

**Kgalagadi Transfrontier Park, inclusive of South Africa**

Groundwater management within the Kgalagadi Transfrontier Park is under the auspices of the Departments of Environment of Botswana and South Africa. Boreholes on the Botswana side of the park are for animals; tourists must bring their own water supplies. In South Africa, boreholes are both for animals and tourist facilities. In Botswana, maintenance and monitoring is conducted by park staff and there is little interaction with the Botswana DWA. However, newer boreholes are drilled in consultation with the DWA. Nevertheless, the Department of Environment indicated an interest in establishing partnership with DWA for managing groundwater in the park and also drilling additional boreholes to make limited supply available to tourists. On the South African side, the staff conducts weekly water level monitoring and facilities checks, albeit using rudimentary yet affordable equipment (see Figure 8.2). The Northern Cape Province regional office of the Department of Water and Sanitation also conducts routine monitoring of water levels and quality. There is a Joint Management Board composed of the Department of Environment for both countries, and the Khomani San indigenous community and the Mier municipal authority from South Africa. The Board makes decisions about park operations including issues of water management, although water regulators are not included in the committee.

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64 Interviewees 1, 35 54.
65 Interviewee 4.
66 Interviewee 3.
67 Interviewee 20.
68 Interviewee 18, 20.
69 Interviewee 15.
70 Interviewee 37.
71 Interviewee 55.
8.3.3 Implications of Stampriet Frameworks’ Evolution

Examining groundwater governance in the Stampriet provides context-specific insights regarding how groundwater governance has been influenced across multiple geographical levels and through scientific and political developments. Looking in terms of politics and policy from the global to local levels, it is clear that the priorities of colonial and apartheid rulers overshadowed the potential influence of the global community. This did not necessarily translate into poor groundwater governance from a resource management perspective, but did result in significant disparities in access, education, public participation and land rights. These have had lasting effect on social equity, land management and resource conservation and also on groundwater resources.

Once independent, the countries’ participation in global governance regimes as well as in the advancement of regional initiatives under SADC was notable. Further, the progressive development of water-related laws and policies in South Africa stood as a key evolutionary marker. Under various laws, policies and programs, all three countries have made clear advances in the sophistication and robustness of groundwater governance – although Botswana is much more in practice than in policy. However, all three countries still face challenges regarding equity and reconciling differences in scope, governance principles, actor participation and procedures within the legal and policy developments.

8.4 Patterns and Legal Pluralism in STAS Governance

The patterns in the normative architecture of the STAS are examined in terms of the four dimensions of sustainable development: political, social, environmental and economic. Within each dimension, the relevant governance texts and practices at multiple levels are assessed.
8.4.1 Groundwater in the Scope of the STAS Framework

Law, policies and program relevant to groundwater governance in the STAS vary in how they include groundwater in their scopes in terms of first, uncertainties regarding the delineation of the STAS and second, the relationship between aquifers and river basins at transboundary and national levels.

The uncertainties regarding the hydrogeological characteristics (see 0) still influence the accuracy of the post-2015 delineation (see SDC/UNESCO GGRETA project) on the South African portion of the aquifer. Consequently, the STAS countries are still debating the nature of STAS’s transboundary flows, what the precise geographic area is that should be governed, what hydrogeological dynamics call for transboundary action, and what the precise relationship is with the Orange-Senqu River Basin given that there are almost never meaningful surface water flows in the STAS area.

ORASECOM which has thus far only focused on surface water, has only recently undertaken studies of groundwater resources and in 2007 established a groundwater task force (ORASECOM 2007). However, as a technical advisory committee, it cannot take legally-binding actions. An additional issue is that ORASECOM also includes Lesotho as a member state. Since ORASECOM has been proposed as a potential coordinating body for groundwater governance in the STAS, the STAS countries are afraid that Lesotho may gain direct influence on their activities.

There are also discrepancies between using the river basin as the planning unit and hydrogeological boundaries within the STAS countries. Botswana’s surface and groundwater laws remain divided and outdated. Thus, Botswana is contemplating moving away from the river basin model in the Kalahari region, specifically to address this issue. Both Namibia and South Africa have streamlined their groundwater laws, although the 2013 Namibian Water Resource Act has not yet entered into force. Namibia has drawn attention to the STAS by declaring it a controlled groundwater area, but lacks groundwater-specific provisions and enforcement power under the 1956 South African water law. South Africa has not completed groundwater resources assessment and planning for the Northern Cape Province, in which the STAS is located. Thus far, the focus has been on the extension of transfer pipelines for the Lesotho Highlands Water Project to the nearby communities.

8.4.2 Patterns in Use of Principles

Table 8.3 depicts the patterns in the use of principles in the laws of the STAS framework. Given, the number of additional policies and practices that exerted a clear influence on STAS governance, a qualitative approach which places these patterns in their greater context is most appropriate for this case. The relevant patterns are discussed in terms of their coherence, incoherence and contradictions in Section 8.5.2, below.

8.4.3 Actor Participation in STAS Governance

An analysis of actor participation in STAS shows that first, these countries do not have the same level of participation in the international groundwater governance frameworks and that this is unlikely to change in the near future. Namibia and South Africa are party to the 1997 UN Watercourses Convention, while Botswana is not. Further, the three countries are unlikely to consider the STAS part of the Orange-Senqu ‘watercourse’ as defined under the Convention. This is because the hydrological relationship between the STAS and the Orange-Senqu River does not unequivocally meet the Conventions’ criteria for including an aquifer as part of a watercourse. First, the actual hydrological connectivity of all the STAS’ layers to the river is debated. Second, the direction of groundwater flow does not lead to a common terminus with the river. Even, if these legal-technical issues within the Convention itself were clarified and the STAS were
### Table 8.3 Inclusion of groundwater governance principles in the STAS framework

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considered part of the Orange-Senqu watercourse under the Convention, it is unlikely that Botswana would sign it because it is party to the 2000 Revised SADC Protocol, which has largely similar content. The Revised Protocol is largely modeled after the UN Watercourses Convention, and is actively implemented through the SADC Secretariat.

Second, donors (e.g. GEF/World Bank, UNESCO-IHP, FAO as well as countries such as UK, Germany, the Netherlands, and Switzerland) have significantly influenced the water governance in the STAS area by actively endorsing the IWRM discourse (Van der Zaag 2005). This creates dependency on donors since there is a shortage of capacity, monitoring and data assessment. In recent years, these organization have shifted their focus from IWRM to hydro-diplomacy, even in the data scarce environments where countries need a better understanding of the resources which they seek to govern in order to effectively engage with each other.

8.5 Discussion: Contributing to Sustainable Development in the STAS

8.5.1 Principles’ Relation to Drivers

I now analyze whether the normative framework addresses the multi-level drivers (see Table 8.2) of groundwater problems. The analysis shows that none of the drivers present in the STAS are fully and effectively addressed by the groundwater governance framework. Thus, I first examine the drivers that the framework either partially addresses or addresses either in policy or practice, but not both. Then, I discuss the drivers that the framework neglects entirely.

The drivers of climate change; customary practices and indigenous knowledge; some non-groundwater policies (e.g., development, energy, food security, forestry); history of colonization/ apartheid legacy; land rights; natural changes in groundwater quality and quantity; pumping and pollution by individuals, local authorities, and commercial agriculture; and spread/migration of flora and fauna are partially addressed in the STAS groundwater governance framework’s texts, but hardly implemented. Grazing, land management practices, and use strategies are not dealt with in code, but are, to a limited extent, dealt with in practice.

The framework does not include any principles calling for climate proofing existing policies to make them adaptive to the possible impacts of climate change, especially given that global climate models indicate groundwater recharge here will fall by at least 10% under all scenarios (Jiménez Cisneros et al. 2014) reducing the available groundwater in the Auob. Botswana is developing a climate policy, but South Africa’s National Water Strategy, which does discuss climate change, and its Climate Response Strategy (2004) only promotes groundwater conservation, and Namibia’s National Policy on Climate Change (2010) does not explain how to deal with the consequences to groundwater. So, while the SADC region is predicted to be vulnerable to climate change and groundwater governance frameworks support adaptation and mitigation in general, there are insufficient groundwater-specific measures.

Natural changes in groundwater quality and quantity as well as pumping and pollution caused by various stakeholders are partially addressed through the principle of protection of groundwater recharge and

72 Interviewee 19.
discharge areas. However, this is only included in the non-binding 2008 ILC Draft Articles. Interestingly, South Africa does include managed aquifer recharge in their national water laws and policies.

The existing governance framework addresses the drivers of pumping and pollution to some extent. Importantly, all three countries establish the governments as the owners/custodians of water resources and have rights/permitting regimes. However, there are serious issues with enforcement and reporting of uses, especially in Namibia. Further, the allocation system in Botswana need to be updated. Since the STAS is a remote area, principles related to capacity building and public education are important for community-level groundwater management but they hardly included.

There are limited structural equity principles that can address the continued effects of apartheid on educational disparities and inequitable land rights within Namibia and South Africa. The reconciliation and redress schemes give communal lands and opportunities to farm to disenfranchised populations but have yet to remove the disparities in access and allocation to groundwater. Further, local uses were not always considered reasonable or ‘beneficial,’ particularly in Namibia.

Non-groundwater policies, land use strategies, and population growth/urbanization have the potential to drive increased groundwater use through expansion of agricultural schemes (and possibly associated overgrazing and spread of groundwater-dependent invasive species), increased ability to pump groundwater and increased demand. While there are several regulations in the Stampriet Framework that would counter these drivers such as licensing schemes and maintaining an ecological reserve, they are not being implemented in a coordinated fashion. Further development policies, particularly in Botswana and Namibia, are inadvertently encouraging movement toward water scarce cities and away from more water secure rural areas. Interviewees recommended a principle or mechanism which would facilitate integrated approaches to managing these challenges.

There are no principles addressing the drivers of global or regional trade in the meat and medicinal products from this region such as cattle feed and Lucerne (Alfalfa). The framework also lacks principles which address the challenges emerging from the tourism industry. Given, the strong links that these industries have to economic growth in this region, this finding implies that economic development may be largely dependent on sustainable groundwater use. Thus, the development of principles addressing these areas is an imperative (see Table 10.1).

### 8.5.2 Incoherence and Contradictions in Principles

The STAS groundwater governance framework varies greatly in terms of coherence across geographic levels, but is notably coherent within each geographic level, particularly the national level. As such the key areas of incoherence are not predominantly in code but rather between code and practice, either in terms of implementation or enforcement. With respect to contradictions, the STAS framework also exemplifies the tensions discussed in Section 4.7. Thus, in a similar approach to Sections 5.4.2, 6.4.2, and 7.4.2, I will discuss the relevant principles, how they are dealt with in practice and highlight key areas of incoherence and contradictions.

The political principles included in groundwater- and water-specific laws and policies range in their relevance and application in the Stampriet. Dispute resolution is included at all geographic levels, including the community level in Namibia and Botswana where groundwater disputes are resolved informally within farmers associations and if necessary with intervention by district councils. However, there is little evidence of water users availing themselves of these resources – particularly in the STAS area. Notification of emergency situations is also included at all levels. The global level, especially the environmental laws and

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73 Interviewees 8, 18, 46.
74 Interviewee 3, 4, 11, 23, 57.
policies, includes the principles of information exchange, the obligation to cooperate, and the peaceful resolution of disputes, which all have a bearing on interstate relations. The latter two of these principles are also emphasized at the regional-transboundary level. At the national-level, the laws also include provisions for establishing enforcement institutions, licensing or permitting regimes, and the ability to access land for groundwater monitoring. While licenses and permits are legally required in all three countries, illegal drilling and improper drilling practices were reported in Botswana and Namibia.\textsuperscript{75} At the subnational level, monitoring may occur in game reserves and among farmers for shared boreholes.\textsuperscript{76} Conducting EIAs is reported at the district level in the countries, noting that the relevant water management authorities are not always included in the assessment process.\textsuperscript{77} Neither, notification of accidents nor data exchange are meaningfully included in the STAS governance framework, indicating an area of incoherence. However, data exchange was a key focal area of the GGRETA project and all countries were interested in establishing a shared data information system for the STAS in the next two years.

With respect to the environmental principles, using the aquifer/basin as the unit of management, EIA, ecosystems protection, monitoring and pollution prevention are included at all geographic levels. In practice ecosystems protection occurs through game reserves and project activities of domestic and international NGOs;\textsuperscript{78} monitoring occurs in game reserves and among farmers for shared boreholes;\textsuperscript{79} and the completion of EIAs is reported at the national and district levels.\textsuperscript{80} The global, regional and transboundary levels also include the notification of planned measures, but this is not translated down to national level. At the national level, the 2013 Namibian Water Resource Management Act and the 1998 South African Water Act include more specific provisions for conservation, establishing an ecological reserve, restrictions on pumping and extraction during water shortage, regulation of waste disposal and wastewater discharge and water quality standards. However, water conservation activities in the three countries are limited in practice.\textsuperscript{81} In Botswana, regulation of waste disposal and discharge is promoted at the district level through land use planning activities.\textsuperscript{82} None of the frameworks include groundwater-specific principles or the principle on invasive species in a significant way. The Orange-Senqu agreement requires control of aquatic weeds but not terrestrial flora that may have an impact on (ground)water resources. This indicates a moderate level of consensus between the countries regarding key environmental principles, but also indicates implementation is a critical challenge.

In assessing the social principles, equitable and reasonable use is the only principle included at all levels. Providing human access to water is also a priority issue at the global, national and subnational levels but the various governance instruments make it explicit in different ways. At the national level, in Botswana, it is framed as the prioritization of vital human needs, while Namibia and South Africa include it as a human right to water. At the subnational level, in Botswana and Namibia, subsistence farmers report enforcing informal rules around equitable use of water in stock management practices.\textsuperscript{83} In Botswana, there are also wells with variable yields that can run out of water for days. In these situations, community members work together to ensure supply to each other.\textsuperscript{84} However, there is one settlement in Botswana that has no access to potable water if the well is not producing water and the community copes by stocking and rationing water.\textsuperscript{85} There

\textsuperscript{75} Interviewees 17, 39, 42.
\textsuperscript{76} Interviewees 4, 37.
\textsuperscript{77} Interviewees 18, 31.
\textsuperscript{78} Interviewees 5, 13, 14, 22, 27.
\textsuperscript{79} Interviewees 4, 37.
\textsuperscript{80} Interviewees 18, 31.
\textsuperscript{81} Interviewees 4, 46, 55, 57.
\textsuperscript{82} Interviewees 28, 31.
\textsuperscript{83} Interviewee 3.
\textsuperscript{84} Interviewees 5, 44.
\textsuperscript{85} Interviewee 1.
are no clear principles or policies regarding how to cope with this situation, indicating a key gap in the framework.

With respect to the rights of women, youth and indigenous peoples, at the global level all three countries are party to the UN CBD, which acknowledges these rights. At the regional-transboundary level, none of the laws or policies include these rights. At the national level, the rights of indigenous peoples are included in the 1967 Botswana Water Act. Namibia’s 2013 Water Act indicates that redress for gender discrimination should be considered in licensing and financial support schemes. Similarly, ‘redressing the results of past… gender discrimination’ is one of the purposes of the 1998 South Africa Water Act (Article 2(c)). However, neither youth nor indigenous peoples are explicitly mentioned in the law. Further, in all three countries these specifics regarding the implementation of these rights, in particular indigenous rights, are negotiated. The rights of women and youth are upheld in policy but their practical status varies in communities (see Van Koppen, B., Giordano, M., Butterworth, J., Mapedza 2007).

Principles supporting public engagement are well supported at the global level, but absent from the transboundary level. At the national level, public participation and public access to information are included in code but prove difficult in practice. In Botswana, regulators facilitate limited public participation through community forums called Thotla meetings. The 2013 Namibian Water Resource Management Act and the 1998 South African Water Act establish water users’ groups through which engagement is facilitated. However, in Namibia this group is only active among farmers in a small area of the aquifer and in South Africa, the group’s formation is still pending a detailed water resources assessment. Further, intergenerational equity is not included in the (ground)water-specific laws and policies. The remaining social principles (i.e. capacity building, human right to sanitation, poverty eradication, prior informed consent) are not significant components of the STAS governance framework at any geographic level. It is worth noting that the 1971 South Africa’s Water Resources Research Act (not fully assessed here) dedicates significant funding to water research. This indicates that there is a complex web of social principles that are present in code but dealt with incoherently in practice and are not well-aligned across levels of governance.

Economic principles are largely absent from the global and regional-transboundary levels of the STAS governance framework. South Africa and Namibia include water as an economic good in the form of cost recovery mechanisms and the user pays principle. They also include the polluter pays principle. All three countries impose fines and penalties for violating the laws. At the subnational levels, cost recovery for water services provision and user payment occurs through the parastatal water utilities. In rural communities that cannot afford to drill boreholes, the Namibian government also provides financial assistance to do so. However, the parastatal water supply in Botswana has no mandate to supply ‘unserviced’ lands, yet these communities are being allocated water and the utility must find a way to provide it. Thus, the analysis indicates coherence around economic principles at the national level, but incoherence across levels.

As discussed in Section 4.5, there are theoretical debates regarding the tension between sovereignty and equitable and reasonable use as well as between the human right to water and sanitation and water as an economic good. Analysis shows that the tensions between sovereignty and equitable and reasonable use is mirrored and to some extent amplified in the STAS governance framework. All the STAS countries participate in global environmental agreements that affirm sovereignty, and Namibia and South Africa are party to the UN Watercourses Convention that emphasized territorial integrity and equitable and reasonable use. The 2000 Revised SADC Protocol affirms state sovereignty and requires equitable allocation via interstate licensing regimes, but the subsidiary Orange- Senqu Agreement includes neither sovereignty nor licensing. While none of the STAS countries mention sovereignty in their national laws and policies, both

86 Interviewee 11, 23, 49.
87 Interviewees 27, 42.
88 Interviewee 43.
89 Interviewee 35.
Namibia and South Africa include equitable and reasonable use and Botswana sets out provisions for establishing an equitable allocation regimes. This indicates that the STAS countries have adopted an approach that acknowledges sovereignty at the regional level, but focuses on equitable and reasonable use as the basis for their allocation regimes both at the transboundary and national levels. In practice, establishing these regimes taking into account groundwater has proven difficult as a result of incomplete information about the STAS’ groundwater resources. It also brings about the question of whether sovereignty stands in the way of equitable sharing; although in the case of the STAS, it seems that more practical factors have caused the allocation and access challenges.

In terms of the human right to water and water as an economic good, review of the STAS governance frameworks shows that South Africa has included the human right to water in its Constitution and implicitly in its water law, Namibia has included it in its water law, and Botswana is working towards implementing the human right to water in practice despite delays in its codification. The human right to sanitation has not received the same attention as the human right to water, either in policy or practice for the three countries. Simultaneously, cost recovery for water services is required by law in Namibia and South Africa and it is an ongoing practice in all three countries. South Africa has already experienced tensions between cost recovery and the human right to water and sanitation through two court cases, wherein citizens claimed that their rights were not being fulfilled (Francis 2005). While there is no record of litigation in Botswana or Namibia, interviewees highlighted the difficulties in achieving equity in access while recovering costs.

8.5.3 Principles’ Relationship to Sustainable and Inclusive Development

This analysis shows that at each geographic level, there is varying emphasis on the different ideal-types of governance principles. It also shows areas where the normative framework for groundwater governance is well supported, has gaps, or is inconsistent across these levels. Figure 8.3 below, summarizes the key areas of the framework and gives an overall impression of its status in the context of sustainable development. It also provides an overall indication of the status of the normative framework with regard to sustainable and inclusive development.

Overall, the normative framework is more developed in governance texts than it is in practice although some exceptions are discussed in the text above. In the texts, the political and environmental norms are the most developed, being highly or moderately present across geographic levels. The key gap in these areas is with respect to the groundwater specific principles. However, in practice, state authority and sharing of groundwater data and information are limited by resources and capacity. Sheer distance between the groundwater users and the offices of national and subnational agencies is a main challenge. Also, there are legal technicalities that hinder enforcement of the current laws in Botswana and Namibia.

The social dimension demonstrates a paradox in texts versus practice. In the governance texts, equitable and reasonable use is the only norm well supported in the texts. Principles regarding access for human needs are moderately supported while those for public engagement and consent are weakly supported, indicating a significant gap. Yet the practical circumstances in the countries have the opposite dynamic. Thus, significant efforts toward attaining equitable and reasonable use are undermined by larger historical, political and economic drivers. For example in Namibia, land tenure rooted both in apartheid and the post-apartheid reconciliation have left people residing in communal lands without the legal, economic, or political capital necessary to significantly increase their access to water resources and move beyond subsistence farming into larger-scale operations. Community-based norms and government initiatives to provide water in rural and remote areas fill the gaps with regard to gaining access for human needs. Public engagement and consent are moderately present in the framework but difficult to achieve in practice, in part because of practical challenges of distance, manpower and language barriers.
In the economic dimension, incentives to improve (ground)water knowledge and infrastructure are lacking while principles with respect to trade is wholly absent at all geographic levels. Cost recovery and penalties are highly supported at the national levels. Yet cost recovery has brought up concerns in practice, for users who cannot afford to pay. However, implementation of cost recovery is resource intensive and predicated on a well-designed and metered distribution system.

With regard to the sub-dimensions of inclusive development, there is limited potential for relational inclusiveness. When focusing on the regional-transboundary and national levels, only the Orange-Senqu agreement and the national laws of Namibia and South Africa, include the notification of emergencies. Prior informed consent is only required in the regional-transboundary agreements and EIA in the Orange Senqu agreement. There is more coherence around the principles of public access to information and public participation, which would support relational inclusiveness if actually implemented. The elements of social inclusiveness were highlighted by several interviewees as requiring more attention. However, within the current framework social inclusiveness is weakly supported by the principles given the tension between cost recovery and the human right to water. Further, capacity building and public education and awareness are nearly absent from the framework even though they would help to re-focus countries from wealth creation to human and natural capital creation. Environmental inclusiveness only has moderate potential due to the widespread inclusion of pollution prevention and significant attention to monitoring and ecosystems protection. However, the absence of conjunctive use and the protection of recharge and discharge zones as well as intergenerational equity, limit prospects along this sub-dimension. Thus, achieving inclusive or even sustainable development would require significant bolstering of several elements of the STAS governance framework.
8.6 INFERENCES

This analysis has shown the complexity of the framework for groundwater governance in the STAS; has contextualized it, historically and socio-politically; and has given some indication of the practical state of implementation and enforcement. As discussed in Section 8.2, the STAS is unlikely to be permanently or completely depleted, although there is evidence that short-term depletion is occurring. Rather, the challenge will be ensuring that critical ecosystems services can be maintained and that shifts in demographics and economic activities can be supported by the quality and quantity of groundwater available. In the STAS region, groundwater receives more attention in policy than in practice, in part due to limitations in data availability, capacity and manpower. Yet groundwater is a key contributor to regional development and growth. Thus, this section presents four conclusions regarding the current state of groundwater governance in the STAS.

First, the formal framework for groundwater governance in the STAS mostly emerged within the last 20 years after the end of the apartheid era. However, the historical influences of colonialism and apartheid clearly influenced how governance is designed. All three of the STAS countries have national laws regulating groundwater, are part of an international river basin that deals with groundwater, and are party to SADC’s regional water protocol, which includes groundwater in its scope. As such, there are multiple geographic levels at which groundwater governance is addressed. Nevertheless, two key definitional issues arise. The first is regarding the STAS itself, how it should be defined, what is the nature of the groundwater problem, and which hydrogeological attributes have transboundary implications. The second is with respect to how the individual groundwater governance instruments define and include groundwater resources in their scope and implementation. In both areas, there is lack of coherence and/or structured activities which will help reconcile these issues, such as a comprehensive modeling and assessment of the STAS or a holistic governance framework jointly implemented by the three countries.

Second, the lack of coherent knowledge on the STAS’ hydrogeology and structure has resulted in sporadic inclusion of the governance principles. Most principles are not explicitly included and a wide range of principles are used but without much consistency within and between geographic levels, resulting in horizontal and vertical pluralism. The SADC Revised Protocol has a discernable influence on groundwater governance practices in each of the countries and in the Orange- Senqu river basin organizations. The highly-regarded South African Water Act has also had a clear influence on the design of the 2013 Namibian Water Law. While both of these developments move groundwater governance in the STAS in the same general direction there is still different emphasis on different governance principles at each geographic level. Political principles are included in every level. However, social principles primarily appear at the international and national levels, where there are incongruences regarding prioritizing human uses or acknowledging the human right to water.

Environmental principles occur at each level but are not always emphasized, only protection and preservation of ecosystems is consistently included. Economic principles are only addressed at the national level. Despite lack of access to water resources for subsistence uses and a semi-arid climate, there is no consistent inclusion of social and environmental issues. The combination of principles is such that if water extraction continues in response to the need for ‘growth’, it might cause further social and ecological problems, thus making it more difficult to achieve inclusive and sustainable development.

Third, the drivers of groundwater governance in the STAS are weakly addressed by the principles. As, discussed above, principles directly addressing climate change are a weakness of the groundwater governance framework worldwide, not just in the STAS. In addition to the uncertainty regarding the discharge mechanisms of the Auob aquifer, climate change in the STAS area is predicted to result in fewer recharge events and eventually a reduction of available groundwater. Given the high level of groundwater dependency in the area, the residual effects of these shifts could directly impact the populations and economies of the STAS countries.
The *de facto* economic principles, that operate beyond the scope of the STAS groundwater governance framework, have substantial impacts on sustainable development in the STAS. The impact of trade on water governance has been discussed thoroughly in the virtual water discourse as well as specifically with respect to (ground)water governance in recent literature (Conti and Gupta 2015; Hoekstra and Hung 2002; Vörösmarty et al. 2015). Nevertheless, principles designed to directly address these issues in the governance framework are absent worldwide. This broad normative gap has clear implications for the STAS given that globalization is driving increased trade in agricultural products from Southern Africa to Northern Europe and is thus a significant driver of groundwater use from low rechargeable groundwater units in the area. This is particularly true of indirect uses that consume ‘green water.’ Increased trade in groundwater intensive products is triggering an increase in groundwater irrigation, consumption of endemic groundwater dependent plant species (especially for medicinal plants), and potential for overgrazing/bush encroachment. Since some studies indicate that evapotranspiration is a significant source of ‘discharge’ for the STAS, governance mechanisms should be designed to address these issues.

The potential effects of demographic shifts and the move towards universal access to water and sanitation, could have impacts on the STAS. The emergence of the human right to water and implementation of the 2015 SDGs drive universal access to water services and result in increased (ground)water use. Changes in demographics such as population growth and urbanization affect groundwater resources in all three STAS countries by increasing local demand for water and sanitation services (also noting the potential for the STAS’ groundwater to be transferred outside of the aquifer area). The naturally occurring saline groundwater constrains the viability of additional extraction and must be a major consideration. However, the framework at present does not deal with naturally occurring contamination.

Fourth, although the overall framework could provide a supportive foundation for sustainable development, the principles supporting the sub-dimensions of inclusive development are not rigorously included and deserve additional consideration. Issues such as maintaining indigenous peoples’ access to groundwater and groundwater dependent species (regardless of land tenure disputes) are not addressed explicitly within the groundwater governance framework. This history of colonization and apartheid has resulted in disparities in education and land rights that effect land management, conservation, public participation and equity. Further, the path to achieving universal access is rife with practical obstacles that lack regulatory instruments and designated financial resources to address them.