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Country profile – Mozambique

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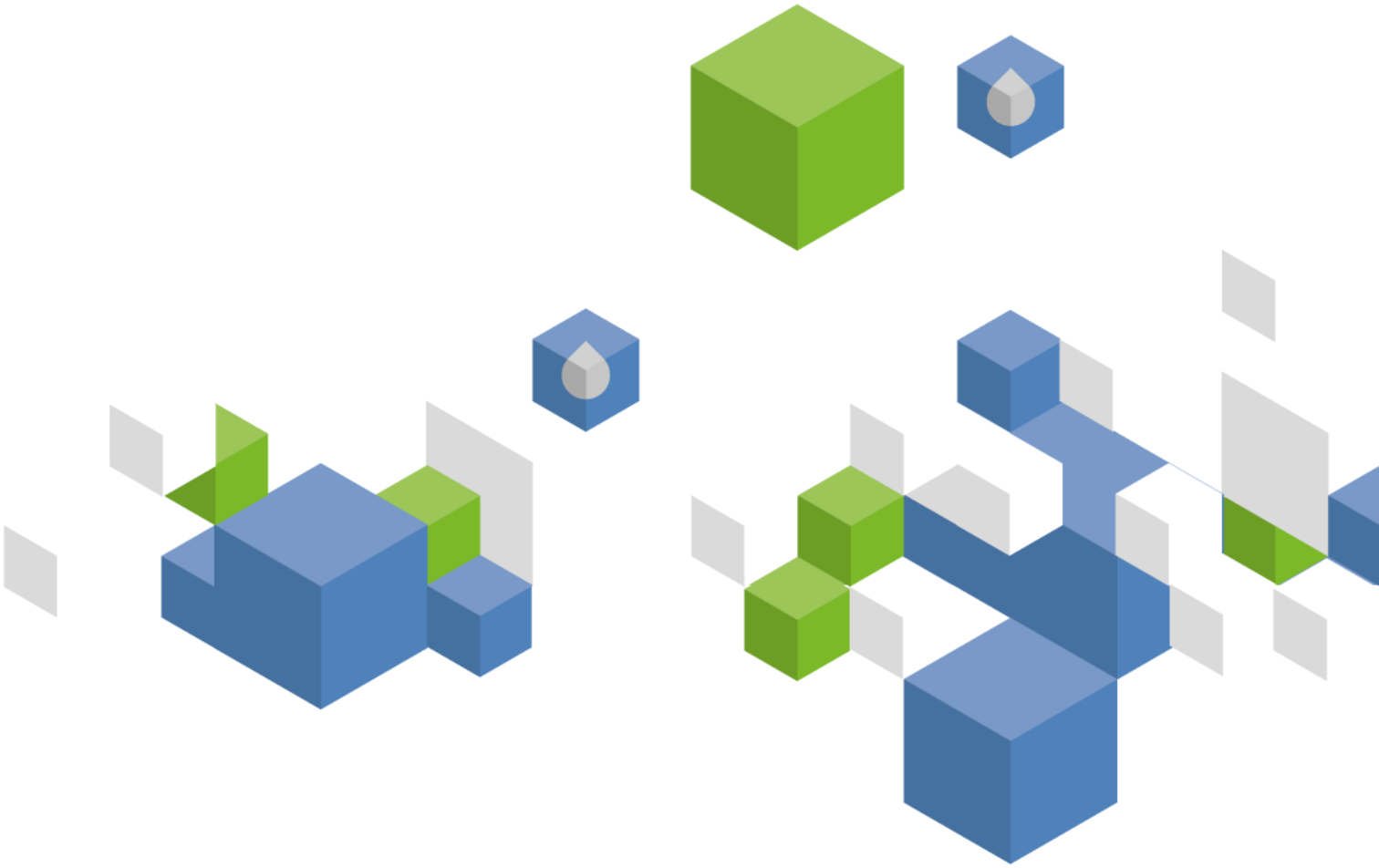

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Mozambique

GEOGRAPHY, CLIMATE AND POPULATION

Geography

Mozambique is located on the east coast of southern Africa on the Indian Ocean. The country is bordered by the United Republic of Tanzania in the north, South Africa in the south, Swaziland in the southwest and South Africa, Zimbabwe, Zambia in the west, and Malawi in the northwest. The country has a total area of 799 380 km^2. The land borders have a length of 4 445 km, while the coastline measures 2 515 km. Monte Binga, culminating at 2 436 m over the Zimbabwe border, is the highest point of Mozambique.

There are three basic geographic divisions:

- A coastal belt which covers about 44 percent of the country, comprising most of the areas south of the Save river and the lower Zambezi area;
- A middle plateau, ranging from 200-1 000 m in elevation and covering about 29 percent of the country;
- A plateau and highland region with average elevations of around 1 000 m to the north of the Zambezi river covering about 27 percent of the country.

The total agricultural land area is estimated at almost 50 million ha, which is 62 percent of the total area of the country. In 2013, the cultivated area was estimated at 5.95 million ha, of which 5.65 million ha arable land, while 0.30 million ha were under permanent crops (Table 1). Permanent meadows and pastures cover 44 million ha.

Climate

The climate varies from tropical and subtropical in the north and central parts of Mozambique to dry semi-arid steppe and dry arid desert in the south. The hottest regions are located in the Zambezi basin, the coastline of Cabo Delgado, Nampula, Zambezia and Sofala. The south is the coolest part of the country, with an average maximum and minimum temperature of 30ºC and 19ºC respectively.

The annual average precipitation for the whole country is 1 032 mm and the rainy season lasts from October to April. It varies widely from the coast to the inland areas and from north to south. Average annual precipitation ranges from 800 mm to 1 000 mm along the coast, with values above 1 200 mm between Beira and Quelimane. It decreases inland reaching 400 mm at the border with South Africa and Zimbabwe. The north and central part of the country has annual precipitation from 1 000 mm to over 2 000 mm because of the northeast monsoon and high mountains. In the southern inland part of the country it ranges from 500 mm to 600 mm. Annual evapotranspiration varies between 800 mm in central Niassa and on the border with Zimbabwe to more than 1 600 mm in the eastern and middle Zambezi basin. Along the coast it varies between 1 200 mm and 1 500 mm.

FIGURE 1
Map of Mozambique

MOZAMBIQUE

FAO - AQUASTAT, 2016

TABLE 1
Basic statistics and population

Physical areas:			
Area of the country	2013	79 938 000	ha
Agricultural land (permanent meadows and pasture + cultivated land)	2013	49 950 000	ha
• As % of the total area of the country	2013	62	%
• Permanent meadows and pasture	2013	44 000 000	ha
• Cultivated area (arable land + area under permanent crops)	2013	5 950 000	ha
- As % of the total area of the country	2013	7	%
- Arable land (temp. crops + temp. fallow + temp. meadows)	2013	5 650 000	ha
- Area under permanent crops	2013	300 000	ha
Population:			
Total population	2015	27 978 000	inhabitants
- Of which rural	2015	69	%
Population density	2015	35	inhabitants/km^2
Economy and development:			
Gross Domestic Product (GDP) (current US$)	2015	14 689	million US$/year
• Value added in agriculture (% of GDP)	2015	26	%
• GDP per capita	2015	525	US$/year
Human Development Index (highest = 1)	2014	0.416	-
Gender Inequality Index (equality = 0, inequality = 1)	2014	0.591	-
Access to improved drinking water sources:			
Total population	2015	51	%
Urban population	2015	81	%
Rural population	2015	37	%

Population

The total population of the country is estimated at almost 28 million (2015), of which 69 percent is rural (Table 1). The annual population growth rate is 2 percent over the period 2005-2015 and the average population density is 35 inhabitants/km².

Mozambique is one of the poorest countries in the world. In 2014, the Human Development Index ranks Mozambique 180 out of 188 countries and the Gender Inequality Index ranks it 135 among 155 countries for which data are available (UNDP, 2016). Life expectancy in Mozambique is 55 years and the under-five mortality is 81 per 1000 births in 2014, both progressing from 48 years and over 180 per 1000 at the end of the 1990s. Over 85 percent of the children in 2014 are enrolled in primary education, with a reduced gap between boys (90 percent) and girls (85 percent) compared to the year 2000 (61 percent of boys against 50 percent of girls). Adult literacy is 59 percent in 2015, with a large gap between female literacy (46 percent) and male literacy (73 percent). Poverty is still widely spread as it concerns over half of the population (55 percent) and is even more concentrated in rural areas (57 percent). In 2015, 81 percent of the urban and 37 percent of the rural population were using improved drinking water sources, that is 51 percent of the total population This represents a small improvement since 2002 when 43 percent of the population had access to an improved drinking water source (JMP, 2015). Sanitation coverage also increased from 14 percent in 2000 to 21 percent in 2015 but with little progress in reducing the gap between rural (10 percent) and urban areas (42 percent).

ECONOMY, AGRICULTURE AND FOOD SECURITY

Mozambique's Gross Domestic Product (GDP) is US$ 14 689 million in 2015 with an annual growth of more than 6 percent since the 2000s. Agriculture contributes 26 percent to GDP and is core to the country's development with about 70 percent of the population depending on subsistence farming. Agricultural production is largely rainfed and has a low productivity with some of the lowest yields in

cereals in southern Africa due to both low inputs and poor access to market. There are 3.7 million farms that can be divided into 2 main categories:

- The smallholder "family" sub-sector accounts for about 98 percent of the area under production and produces almost all the food crops, such as maize, cassava, rice and beans. It is characterized by small areas (1.8 ha each on average), low inputs, inadequate equipment and low yields and returns. Almost all production is rainfed, as the farmers cannot afford to install irrigation systems. Within this sector a small group of emergent commercial farmers exists who use some agricultural inputs and sell their products in local markets. This group believes that one of their prime needs is the establishment or improvement of irrigation systems. However, to be able to do this first land registration is required since 97 percent of them do not have a legal land title.
- Small and medium private companies represent the growing commercial sub-sector. These companies have some technological know-how, use agricultural inputs, generally have access to credit and, particularly in the south of the country, have access to irrigation. They are an important source of employment and notably contribute to technology dissemination and transfer. Their production is directed to supplying national markets, the agro-industries and for exportation. The main export crops are cotton, cashew nuts, sugarcane, tobacco and tea.

Since the end of the civil war in 1992, Mozambique has made impressive gains in restoring food production. At national level the country is virtually self-sufficient in terms of food grain production, with the exception of wheat and rice. However, this growth has been uneven spatially and natural disasters such as flood and drought are an important cause of temporary food insecurity. The 2000 flood and the 2016 drought for example resulted in higher imports of wheat to fight food deficit. The portion of population that is undernourished was 25 percent over the period 2014-2016 (FAO, 2016). The northern provinces of Cabo Delgado and Nampula have the highest rates of chronic malnutrition.

On the other hand, agriculture still contributes to export revenues with cash crops, such as cashew, cotton, tobacco, sesame, sugarcane and tea, covering about one quarter of the cultivated area. Livestock is also significant with almost 1.3 million cattle and 4.1 million little ruminants in 2010. In addition, the potential for timber production is enormous (MA, 2014).

WATER RESOURCES

Mozambique has 104 identified river basins that drain the central African highland plateau into the Indian Ocean. The majority of the rivers have a highly seasonal, torrential flow regime, with high flows during 3-4 months and low flows for the remainder of the year, corresponding to the distinct wet and dry seasons. Out of these 104 basins, 13 main rivers, including Zambeze, Pungue, Buzi, Save, Limpopo, Incomati, Umbeluzi, Rovuma and Maputo, are shared with neighbouring countries. The Zambeze river is the fourth longest river in the African continent and the longest flowing into the Indian Ocean from Africa. The Limpopo river is the second major river in southern Africa with a length of 1 750 km. This river and its tributaries show great seasonality and some tributaries are even just episodic. While Mozambique is well endowed with water resources, the fact that many major rivers originate outside the country, makes it highly vulnerable (MINAG, 2010).

There are two main natural lakes. Lake Niassa, shared with Malawi and the United Republic of Tanzania, is the southernmost of the large Rift Valley lakes with a surface area of 30 800 km^2, of which 21 percent belong to Mozambique. The second lake, Lake Chiura, has a surface area of 750 km^2 and is shared with Malawi. In addition, there are more than 1 300 small lakes, 20 of which have an area between 10 and 100 km^2, as well as 6 main artificial lakes. The total capacity of 27 dams with a height of 10 m or more is estimated at 74 137 million m^3. The largest reservoir is the Cahora Bassa Lake created in 1973 on the Zambezi river, hosting the largest hydroelectric plant in southern Africa with an installed capacity of 2 060 MW. The Chicamba Real dam on the Revue river, the Massingir dams on the Elephants river, the Corumana dam on the Sabie river and the Pequenos Libombos dams on the Umbeluzi river, providing drinking water for Maputo, are other major dams (NEPAD, 2013). In 1971, 583 small dams with a total

volume of 60 million m^3 were registered, of which 90 percent were for irrigation or livestock watering. It is believed that most of them were destroyed during the war.

Mozambique has listed two Ramsar sites in 2013, the Lake Niassa and the Marromeu complex interlinked with the Zambezi delta, with a total area of more than 2 million ha (Ramsar, 2013). Mangrove forests cover an estimated 400 000 ha along the coast, deltas and estuaries of rivers such as the Zambezi, Pungue, Save, Limpopo, Maputo and Rovuma (USAID, 2013). There are also a number of lagoons, in particular the Bilene or Uembje lagoon.

Groundwater potential is considerable and lies in the alluvial formations of the various rivers. Well yields in the Zambezi and Incomati basins are up to 70 000 m^3/day.

Internal renewable surface water resources are estimated at 97 300 million m^3/year and renewable groundwater resources at around 17 000 million m^3/year. Considering an overlap between surface water and groundwater of 14 000 million m^3/year, the total internal renewable water resources (IRWR) are 100 300 million m^3/year (Table 3). External renewable water resources are estimated at 116 810 million m^3/year, as follows: 14 100 million m^3/year from the Mazowe river from Zimbabwe, 73 200 million m^3/year from the Zambezi river from Zambia, 3 400 million m^3/year from the Umeluzi river from Swaziland, 8 530 million m^3/year from the Elephant river and smaller rivers from South Africa, 16 980 million m^3/year from the Shire river from Malawi and 600 million m^3/year from the Limpopo river from Botswana. This gives a dependency ratio of 54 percent and the total renewable water resources are 217 100 million m^3/year, or 7 760 m^3/year per capita in 2015. Surface water leaving the country to other countries is estimated at 1 000 million m^3/year through the Ruo river to Malawi.

TABLE 2
Water resources

Renewable freshwater resources:			
Precipitation (long-term average)	-	1 032	mm/year
	-	825 000	million m^3/year
Internal renewable water resources (Long-term average)	-	100 300	million m^3/year
Total renewable water resources	-	217 100	million m^3/year
Dependency ratio	-	54	%
Total renewable water resources per inhabitant	2015	7 760	m^3/year
Total dam capacity	2015	74 137	million m^3

Despite the long Mozambique's coast, desalination is limited to specific industrial sites.

There are limited wastewater treatment infrastructures in the country. Maputo was the only city with a central sewage system for collection and treatment of domestic sewage until 2012, when a plant opened in Beira city. Around 70 percent of the Mozambique's population uses pit latrines. Around 22.8 million m^3 of wastewater is discharged through sceptic tanks. Another 29.865 million m^3 of wastewater is estimated to be generated in 2007 from the population connected to a sewage system. The Maputo treatment plant consists of a series of anaerobic and facultative tanks, which are designed to treat organic matter from half of the population of Maputo. However, it is not functioning due to operational and maintenance problems, and thus is discharging directly into the Ocean. Wastewater generated in industries is discharged into the Indian Ocean without any treatment (UNEP, 2009).

INTERNATIONAL WATER ISSUES

Mozambique shares nine river basins with other countries, as well as a number of aquifers (Table 3):

- The Maputo basin, shared with South Africa and Swaziland. The river flows through an area of rich biodiversity recognized by UNEP, having the status of a world conservation area.

- The Umbeluzi basin, shared with South Africa and Swaziland. The river is important for the water supply of the capital Maputo. A large irrigation scheme exists in Swaziland and there are smallholder schemes in Mozambique. The two countries have signed an agreement for water sharing, but this agreement is not favourable to Mozambique.
- The Incomati basin, shared with South Africa and Swaziland. Water is intensively used in South Africa, mainly for irrigation, and Mozambique has some important irrigation schemes too. The flows in the main river have been very much reduced in the last 15 years.
- The Limpopo basin, shared with Botswana, South Africa and Zimbabwe. The largest irrigation scheme of Mozambique, Chokwé, is located in this basin. Intensive water use in the upstream countries, especially Zimbabwe and South Africa, reduces the flows entering Mozambique. The river is now dry for 3 or 4 months in a normal year, and can actually fall dry for a period of up to 8 months in a year. There are also water quality problems at the border inflows.
- The Save basin, shared with Zimbabwe. During the 1980s, Zimbabwe carried out an intensive programme for water resources development in this large basin. As a result, the Save is now dry almost on a permanent basis.
- The Pungue basin, shared with Zimbabwe.
- The Zambezi basin, shared with Angola, Botswana, Malawi, Namibia, United Republic of Tanzania, Zambia and Zimbabwe. It is one of the largest river basins in Africa and the most important one in Mozambique. It accounts for about 50 percent of the surface water resources of the country and about 80 percent of its hydropower potential with the Cahora Bassa dam.
- The Rovuma basin, shared with the United Republic of Tanzania.

TABLE 3
Transboundary aquifers (Source: IGRAC, 2014)

Basin	Total aquifer area (km^2)	Shared with
Coastal Sedimentary Basin III	23 075	United Republic of Tanzania
Coastal Sedimentary Basin VI	11 700	South Africa
Rhyolite-Breccia Aquifer	4 916	South Africa, Swaziland
Limpopo Basin	19 961	South Africa, Zimbabwe
Save Alluvial	11 477	Zimbabwe
Shire Valley Alluvial Aquifer	6 223	Malawi
Arangua Alluvial	21 235	Zambia
Karoo Sandstone Aquifer	40 007	United Republic of Tanzania

Mozambique signed and ratified the Southern Africa Development Community (SADC) Shared Water Course System Protocol in 1995 and its revised version in 2000. There are many agreements between Mozambique and upstream neighbouring countries regulating the use of shared watercourses. In 2004, a tripartite agreement was ratified with Swaziland and South Africa regarding the management of the Incomati and Maputo rivers.

Rivers in the south of the country are heavily dependent on water resources from upstream countries. The increasing demand for water in the upstream South Africa, Swaziland and Zimbabwe poses a challenge for the future of water resources' supply in the country (NEPAD, 2013).

WATER USE

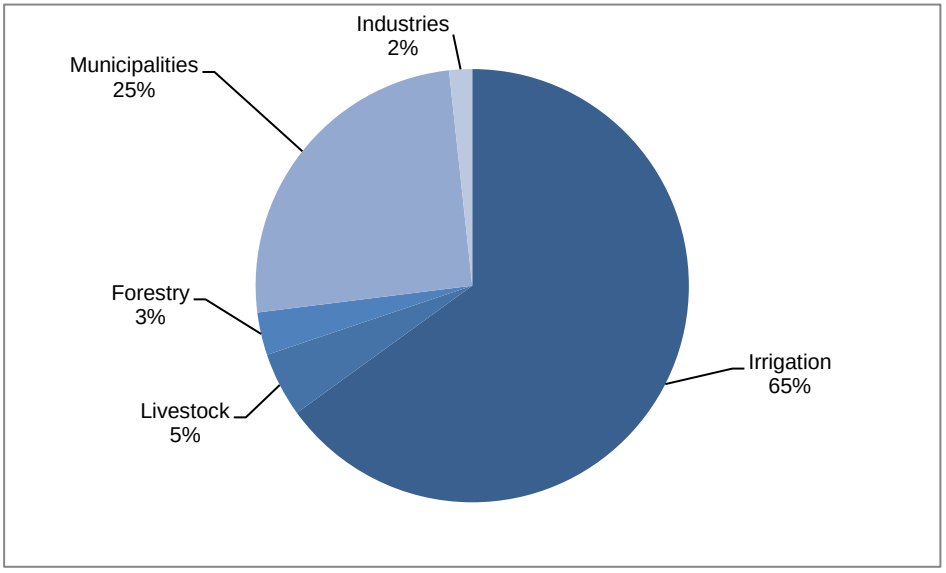
The total water withdrawal in 2000 was estimated at 884 million m^3, of which 78 percent for agricultural purposes. In 2015, total water demand is estimated at 1 473 million m^3 (Table 4 and Figure 2). The main demand of water remains agriculture, accounting for 1 076 million m^3 (73 percent), of which 958 million m^3 for irrigation of crops, 71 million m^3 for livestock and 47 million m^3 for forestry. The municipal sector demands 372 million m^3 (25 percent) and the industrial sector 25 million m^3 (2 percent) (NEPAD, 2013).

TABLE 4
Water use

Water withdrawal:			
Total water withdrawal	2015	1 473	million m^3/year
- Irrigation	2015	958	million m^3/year
- Livestock	2015	71	million m^3/year
- Forestry	2015	47	million m^3/year
- Municipalities	2015	372	million m^3/year
- Industry	2015	25	million m^3/year
• Per inhabitant	2015	53	m^3/year
Surface water and groundwater withdrawal (primary and secondary)	2015	1 473	million m^3/year
• As % of total renewable water resources	2015	0.7	%
Non-conventional sources of water:			
Produced municipal wastewater	2007	51.9	million m^3/year
Treated municipal wastewater		-	million m^3/year
Direct use of treated municipal wastewater		-	million m^3/year
Direct use of agricultural drainage water		-	million m^3/year
Desalinated water produced		-	million m^3/year

Note: The figures in this table refer to water demand and not water withdrawal

FIGURE 2
Water withdrawal by sector
Total 1 473million m^3 in 2015



The main source of water in Mozambique is surface water, with increasing water scarcity in the Umbeluzi, Limpopo and Buzi river basins. However, groundwater is utilized on a large scale in a number of urban centres for drinking water supply, as well as in rural areas.

IRRIGATION AND DRAINAGE

Evolution of irrigation development

Irrigation potential was estimated to be around 3.1 million ha by FAO, while other sources give 3.3 million ha. The major areas suitable for irrigation are in the centre and north. The Zambezia province alone accounts for about 60 percent of the irrigation potential. The southern provinces have the highest need for irrigation but have only a small share of the land suitable for irrigation.

Smallholder "traditional irrigation" has been practiced for centuries in Mozambique in particular in *dambos* (inland valley bottoms) and peatlands, mostly concentrated in the central and north high rainfall areas at the headwaters of most streams. Formal irrigation development through government or private

investments is only recent. In 1968 the area equipped for irrigation totalled 65 000 ha, of which 72 percent were located in the Maputo and Gaza provinces. This includes only parts of the Chokwe irrigation scheme initiated in the early 1960s, reaching later 25 000 ha and thus being the largest in the country. In 1973 the area equipped for irrigation had increased to 100 000 ha due to the establishment of sugar companies in the Incomati, Buzi and Zambezi valleys (34 000 ha equipped area) and Limpopo settlers, with the major area still being located in the southern provinces of Maputo and Gaza. Portuguese settlers mainly exploited these lands, while Mozambicans did not practice irrigated agriculture. At independence in 1975 irrigation qualified staff and settlers left the country and private investments stopped. An inventory carried out in 1986-87, identified a total equipped area of almost 120 000 ha, of which approximately 42 000 ha were fully operative (INIA and FAEF, 1999). Most of the areas were again in Maputo and Gaza, where significant water development works were implemented at the same time: the Pequenos Libombos, the Corumana and the Massingir dams. In the years following independence, the government encouraged the exploitation of existing large irrigation schemes by state companies. These companies however became a symbol of inefficiency, mismanagement and the subsequent deterioration of the irrigation infrastructures. As a result, most were transferred to the private sector. Whereas 90 percent of the irrigated area in 1983 was owned by State farms, the remaining being equally distributed between cooperatives and small farmers, since the 1990s the same area was divided almost equally between commercial farms and smallholders.

Smallholder irrigation exists everywhere in the country, but is either abandoned or just partly utilized. Most of the schemes are in a bad to very bad condition, and only a relatively small part of the irrigation schemes is actually irrigated. Reasons for this are:

- After independence the original owners abandoned the irrigated lands, and the new owners greatly lacked experience in operation and maintenance of irrigation schemes.
- The extended civil war led to the destruction of irrigation infrastructures and forced the abandonment of others.
- Public funds for irrigation were gradually reduced.
- The lack of funding and technical assistance in the rural areas for operations, maintenance and improvements of irrigation schemes, led to their degradation.
- The floods in 2000 and 2001 completely submerged many irrigated schemes and deposited large quantities of sediments in all natural and human-made irrigation and drainage channel networks.

In 2001, 118 120 ha were equipped for irrigation. The actually irrigated area was 40 063 ha, of which almost 80 percent in large schemes (> 500 ha), including 23 500 ha of sugar estates. In 2010, the total area equipped for irrigation is still the same (MINAG, 2014). However, there has been some rehabilitation on around 27 000 ha during the period 2001-2009, of which over 15 000 ha in the Gaza province alone (MINAG, 2013). In 2010, 62 000 ha are actually irrigated (Table 5), of which only about 30 000 hectares are used for food production, while the remaining area is used for ethanol production from sugarcane. About 60 000 ha remain in need of rehabilitation, of which 15 000 ha are considered not viable for recovery for agricultural purposes, except for aquaculture (MINAG, 2014).

Basin irrigation is practiced for rice and furrow irrigation for maize, other cereals and vegetables. Sprinkler irrigation is widespread with agricultural companies, especially in sugarcane plantations, but also for cotton, citrus fruits and vegetables and in the majority of the recently constructed schemes. Some producers employ localized irrigation to produce tomatoes (3 347 ha in 2001).

In most irrigation schemes, surface water from rivers is used. Groundwater is used to a very limited extent by the family smallholder sector.

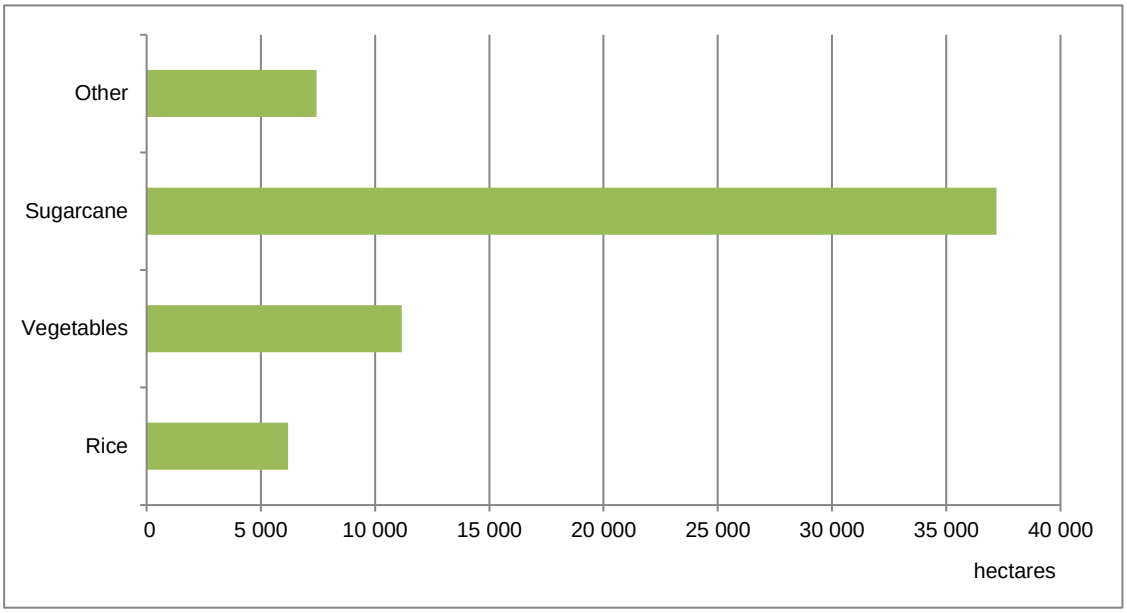
TABLE 5
Irrigation and drainage

Irrigation potential			3 072 000	ha
Irrigation:				
1. Full control irrigation: equipped area		2010	118 120	ha
- Surface irrigation			-	ha
- Sprinkler irrigation			-	ha
- Localized irrigation			-	ha
• Area equipped for full control irrigation actually irrigated		2010	62 000	ha
- As % of area equipped for full control irrigation		2010	52	%
2. Equipped lowlands (wetland, ivb, flood plains, mangroves)			-	ha
3. Spate irrigation			-	ha
Total area equipped for irrigation (1+2+3)		**2010**	**118 120**	**ha**
• As % of cultivated area		2010	2	%
• % of area irrigated from surface water			-	%
• % of area irrigated from groundwater			-	%
• % of area irrigated from mixed surface water and groundwater			-	%
• % of area irrigated from non-conventional sources of water			-	%
• Area equipped for irrigation actually irrigated			-	ha
- As % of total area equipped for irrigation			-	%
• Average increase per year		2001-2010	0	%
• Power irrigated area as % of total area equipped for irrigation			-	%
4. Non-equipped cultivated wetlands and inland valley bottoms			-	ha
5. Non-equipped flood recession cropping area			-	ha
Total water-managed area (1+2+3+4+5)		**2010**	**118 120**	**ha**
• As % of cultivated area		2010	2	%
Size of full control irrigation schemes:	**Criteria**:			
Small schemes	< 50 ha	2010	6 389	ha
Medium schemes	> 50 ha and < 500 ha	2010	19 650	ha
Large schemes	< 500 ha	2010	92 080	ha
Total number of households in irrigation				
Irrigated crops in full control irrigation schemes:				
Total irrigated grain production			-	metric tons
• As % of total grain production			-	%
Harvested crops:			-	
Total harvested irrigated cropped area		2010	62 000	ha
• Temporary crops: total		2010	62 000	ha
- Rice		2010	6 200	ha
- Vegetables		2010	11 200	ha
- Sugarcane		2010	37 200	ha
- Other temporary crops		2010	7 400	ha
• Permanent crops: total		2010	0	ha
Irrigated cropping intensity (on full control area actually irrigated)		2010	100	%
Drainage - Environment:				
Total cultivated area drained			-	ha
• Non-irrigated cultivated area drained			-	ha
• Area equipped for irrigation drained			-	ha
- As % of total area equipped for irrigation			-	%
Area salinized by irrigation		1995	2 000	ha
Area waterlogged by irrigation			-	ha

Role of irrigation in agricultural production, the economy and society

The main irrigated crops are sugarcane, increasingly for ethanol production, vegetables and rice (INIR, 2013b; Figure 3). The 2009-2010 agricultural census indicates that 201 747 farms use irrigation (INE, 2013). The average rice yield in Chokwe irrigation scheme is very low at 2.1tons/ha (ODI, 2015).

FIGURE 3
Harvested irrigated area
Total 62 000 ha harvested irrigated in 2010



The climate of Mozambique means that the risk of harvest loss in rainfed agriculture exceeds 50 percent in all regions south of the Save river, and can reach up to 75 percent in the interior of the Gaza province. The centre and north regions of the country have more appropriate conditions for rainfed agriculture, where the probability of good harvests during the wet season is 70-95 percent. The north of the Manica province and the south of the Tete province regions are excluded from this Centre-North region, as they have a risk of harvest loss in rainfed crops of usually more than 50 percent.

Women and irrigation

At smallholder level, high value crops are traditionally grown by men. Although women play an active role in all activities of irrigated production, they are in general not involved in planning and decision-making regarding the management of the scheme.

Historically, and due to cultural habits, men from the more powerful and settled group have had the greatest access to benefits and increased income from irrigated agriculture. Women, migrant groups and poorer social classes have often lost access to resources and gained increased workloads. Conversely, the increased income and improved nutrition from irrigated agriculture benefit women and children in particular (WB, 2010).

WATER MANAGEMENT, POLICIES AND LEGISLATION RELATED TO WATER USE IN AGRICULTURE

Institutions

The main public institutions involved in water resources management and irrigation in the country are:

- Ministry of Agriculture (MINAG) in particular:
  - National Directorate for Agrarian Services (DNSA) through its Department for Hydraulic Engineering (DEH) assumes the responsibility to authorize irrigation schemes and replaces since 2012 the National Directorate for Agricultural Hydraulics (DNHA)–itself replacing the State Secretary for Agricultural Hydraulics (SEHA) created in 1995.
- The Ministry of Public Works and Housing (MOPH) is responsible for water policy and management and its:

- National Water Directorate (DNA) carries out inventories of water resources and needs and issue licenses for water uses. It oversees:
    - Department of Water Resources Management (DGRH)
    - Office of International Waters (GRI)
    - Office of Hydraulic Works (GOH)
    - Office of Planning and Control (GPC)
    - 10 provincial Directorates of Water (DAs)
- The Ministry for Coordination of Environmental Affairs (MICOA) is responsible for coordinating all matters concerning the sustainable use of natural resources and environment protection

The Fund for Agricultural Hydraulics Development (FDHA) is in charge of promoting, fostering and funding hydro-agricultural works or other activities related to irrigated agricultural development.

The National Water Council (CNA) was created in 1991 as a consultative body to the Council of Ministers. In general, however, the CNA has not been very effective and coordination between agencies involved in water resources management has been a constant source of concern.

The National Irrigation Institute (INIR), created in 2012 simultaneously with the DNSA, is to ensure the efficient and sustainable planning, development and management of land and water resources for production. It is in charge of promoting the rehabilitation and construction, operation and maintenance of irrigation infrastructures, as well as supporting the establishment of water users associations, and participating in integrated water resources management plans.

Water management

At regional level, water management and development is the responsibility of the five Regional Water Administrations (ARAs) in their respective river basins (Table 6). They control the irrigation systems, collect water fees and hydrological data. They have administrative and financial autonomy but report to the DNSA. The only two ARA fully operational by 2010 were ARA-Sul, south of the Save river where most of the water management problems exist, and ARA-Centro. In areas not yet covered by an ARA, the Provincial Directorates of Public Works and Housing are the authority responsible for water resources management in the province.

TABLE 6
ARA river basins (Source: NEPAD, 2013)

ARAs	River basins
ARA-Sul	Maputo, Umbeluzi, Incomati, Limpopo and parts of Save (in Gaza and Inhambane provinces)
ARA-Centro	Save (in the Sofala and Manica provinces), Buzi, Pungue
ARA-Zambeze	Zambeze
Ara-Centro Norte	Licungo, Ligonha and Lúrio
ARA-Norte	Messalo and Rovuma

Finances

The 1998 *Water Tariff Policy Resolution* (N˚60/98) established price for water, but it is subsided.

In Chokwe irrigation schemes, farmers pay a water fee amounting to an average of US$14/ha in the wet season, and US$25/ha in the dry season depending on the number of hectares owned by farmers. However, only 35-40 percent of farmers paid in 2013 as a consequence of the losses experienced after the flood (the payment rate was slightly higher in previous years).

The costs for surface irrigation range from US$1 500/ha to US$2 000/ha, while maintenance costs can vary between US$500/ha and US$1 500/ha depending on the condition of the system (ODI, 2015).

Policies and legislation

The new Constitution adopted in 2004, compromises the government to assure sustainable development preserving the environment to improve the quality of life of its citizens (Article 117).

The *1991 Water Law* (N°16/91) is the main legislation on water in the country. It is based on a river basin approach towards water management. According to this law, water and hydraulic structures of public interest are State property. Numerous decrees since then detail its practical enforcement, in particular:

- Decree N°134/1993 on decentralized and integrated management of water resources at river basin level and formally establishing the ARAs
- Decree N°15/2004 approving the regulation on municipal water supply and wastewater treatment
- Decree N°45/2004 conditioning the activities with significant adverse impacts on the environment, such as irrigation systems for areas of more than 350 ha, to an Environmental and Social Impact Assessment (ESIA).
- Decree N°43/2007 approving the regulation for licensing the concessions for water use.
- Ministerial Order N°7/2010 approving model forms of licences and concessions for water use.
- Decree N°9/2012 establishing the INIR
- Decree N°18/2012 approving the regulation on research and exploitation of groundwater

To operationalize the *1991 Water Law*, the 1995 National Water Policy aimed to guarantee the attainment of a sustainable water supply and sanitation, but also referred to agricultural water management in particular in order to promote private sector participation to make full use of the existing infrastructures, as well as their rehabilitation and extension. The 2007 National Water Policy reviews and updates the previous one with the main objectives towards 2025 to:

- Satisfy basic needs of human water consumption
- Improve sanitation in urban and rural areas
- Use water efficiently for economic development
- Preserve water for environmental conservation
- Reduce vulnerability to floods and droughts
- Reach agreements on water allocations and management coordination for international river basins (WB, 2010).

The 2007 National Water Policy is further detailed with the 2007 National Water Resources Management Strategy (NWRMS) covering all relevant aspects of IWRM including the need for gender mainstreaming in water resources management (MINAG, 2010).

Similarly, replacing the 2002 National Irrigation Policy and its Implementation Strategy the National Irrigation Strategy for the period 2011-2019 was approved by the government for an estimated cost of US$ 654 million to double the total irrigated land in the provinces of Sofala, Manica and Zambézia from 66 000 hectares to 113 000 hectares by 2019 (AfDB, 2011).

More generally, Mozambique has developed a number of policies for the development of the agricultural sector and food security: the Strategic Plan for the Development of the Agricultural Sector 2011-2015 (PEDSA), the Food and Nutritional Security Strategy II (ESAN II, 2008-2015), the Multi-sectoral Action Plan for the Reduction of Chronic Malnutrition in Mozambique (PAMRDC) 2011-2020, and the 2013 National Agriculture Sector Investment Plan (PNISA). PNISA gives priority to the production of food and cash crops. It streamlines reduction of drought and flood vulnerability with a hydro-agricultural programme aiming at: i) reducing the impact of drought by introducing or expanding alternative irrigation methods (use of groundwater, transfer of water to highly water-stressed areas); and ii) reducing vulnerability to flooding around irrigated areas (MA, 2014).

ENVIRONMENT AND HEALTH

Despite many rivers in Mozambique being under intense pressure from various uses, particularly the transboundary rivers, many others are in almost pristine state (WB, 2010). Pollution of water from agriculture is not significant, because most production is by smallholders, who use little fertilizer and other artificial inputs. Pollution exists however from discharge of untreated wastewater from domestic sewage and industrial activities (SIDA, 2011).

Erosion and resulting sedimentation, due to conversion of forests into cultivated lands, as well as artisanal mining also impact on the river basins' flows.

Saline soils do occur in some areas in the country as a result of poor water management or the use of saline water for irrigation, such as parts of the Chokwé irrigation scheme. However, there are also areas where saline soils occur naturally in Mozambique. This situation is common in the dry zone in the southern part of the country, in the Gaza province in the area of Pafuri, where annual rainfall is below 400 mm.

PROSPECTS FOR AGRICULTURAL WATER MANAGEMENT

One of the five main aims of the second Action Plan for the Reduction of Poverty (PARPA-II) 2006-2010, and of its continuation the PARP 2011-2014, was to promote the construction and rehabilitation of agricultural infrastructure, especially irrigation schemes, as well as to improve community access to natural resources in an equitable manner for sustainable use and management (WB, 2009).

The 2013 National Agriculture Sector Investment Plan (PNISA)'s strategy is to develop infrastructure for irrigation, including development of wetlands for agricultural development, as well as water storage for livestock and aquaculture. Its objectives are to:

- expand the irrigated areas by at least 50 000 ha by 2020, of which at least 20 000 ha through private investments
- add a capacity of 30 million m^3/year of water storage through rehabilitation and construction of small dams
- raise the level of utilization of irrigation schemes from just over half at present to 80 percent
- develop the professional capacity of the public irrigation services both at central and local level, in particular within the INIR at national level

In order to harmonize the interventions a Consultative Forum on Irrigation will be established, headed by the Minister of Agriculture, on which the key stakeholders of the public and private sectors will be represented (MINAG, 2014).

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