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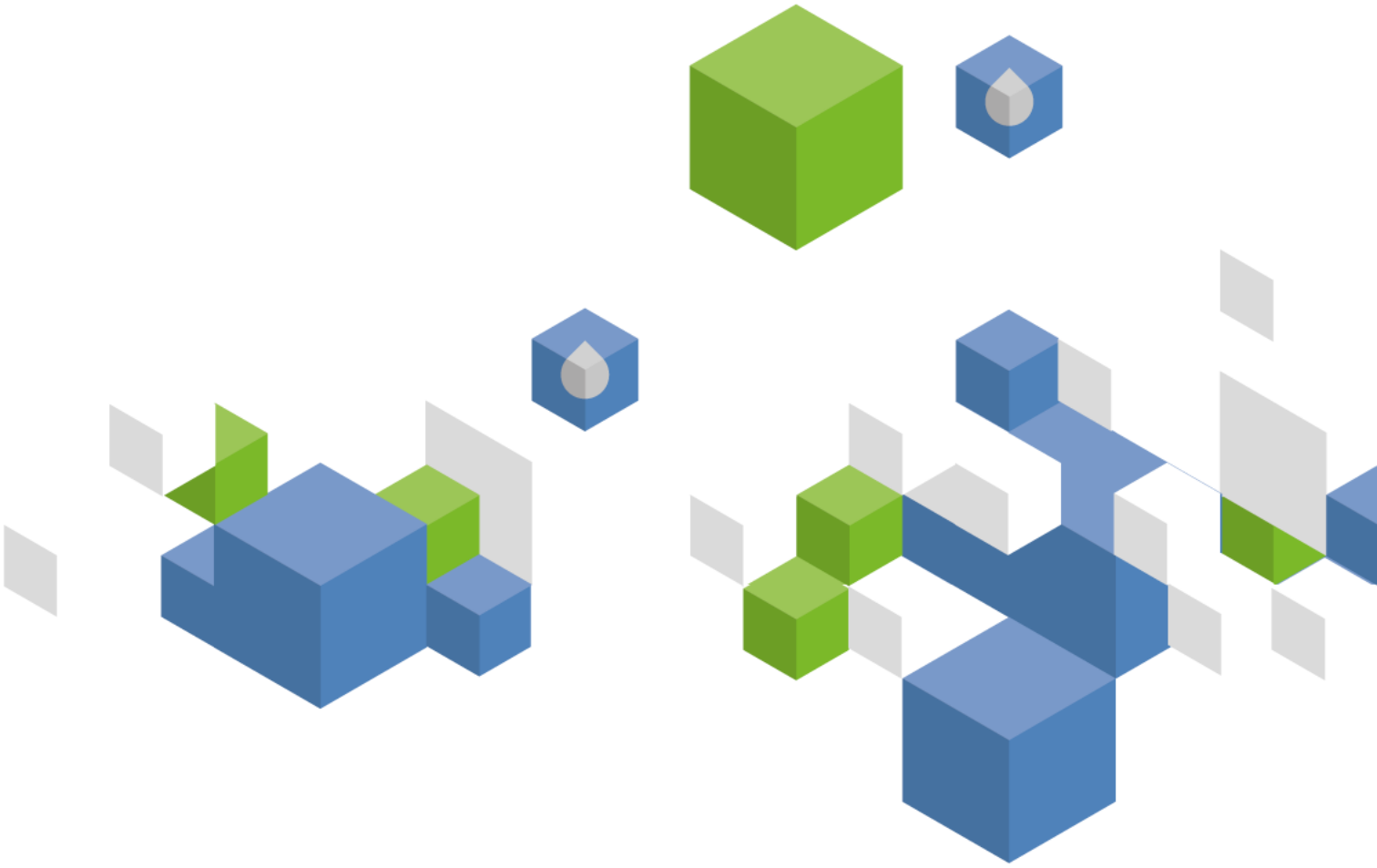

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Mauritius

GEOGRAPHY, CLIMATE AND POPULATION

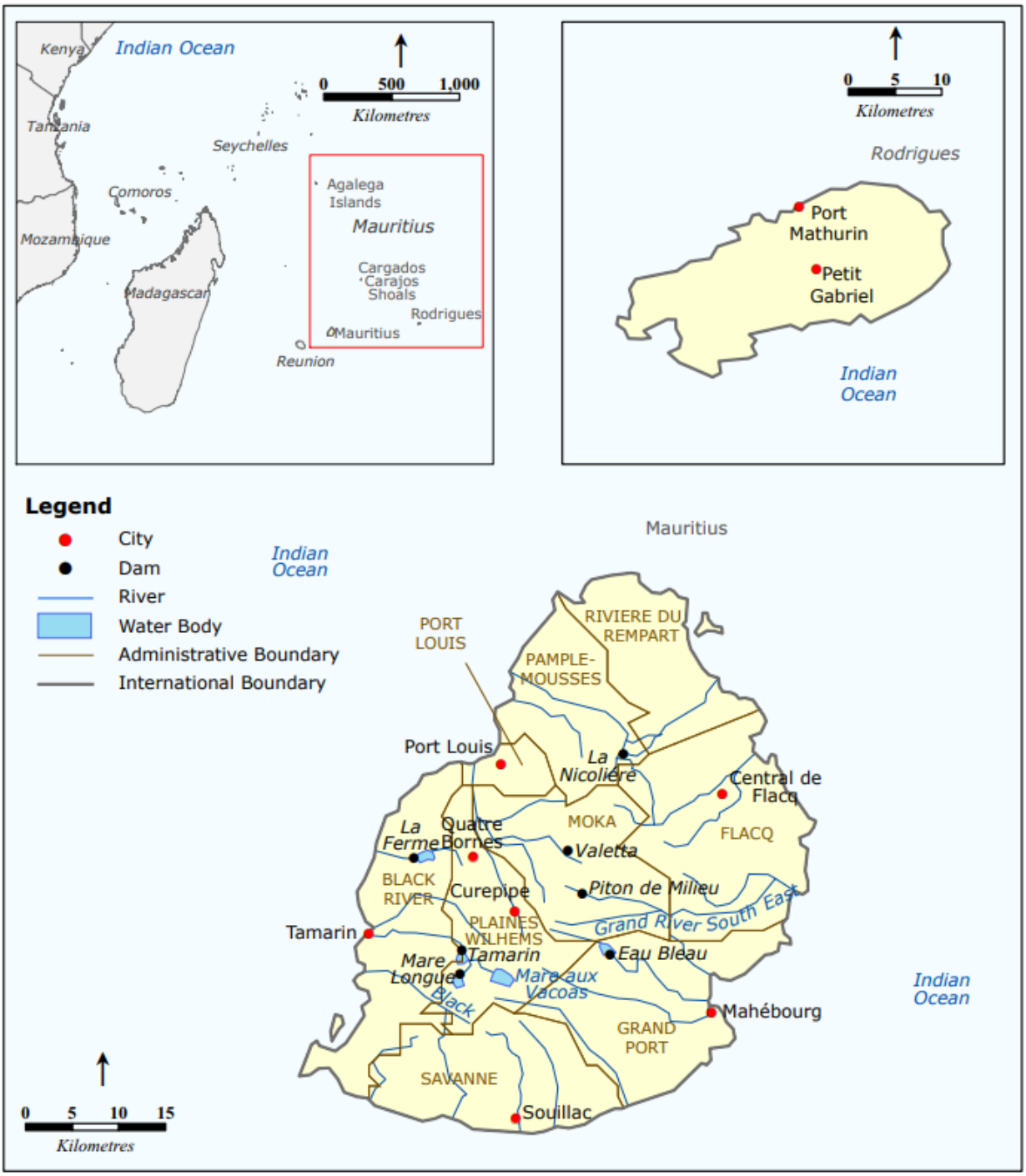
Geography

The Republic of Mauritius is an island country in the Indian Ocean, 950 km to the east of Madagascar. It has a total area of 2 040 km^2, consisting of the island of Mauritius itself (1 865 km^2), and the islands of Rodrigues, Agalega and the Chagos Archipelago. The island of Mauritius consists of an undulating central plateau with coastal plains in the north and east. The southern and southeastern escarpments of the plateau are steep and rugged. The island is surrounded by coral reefs and is of volcanic origin. Soils are mainly derived from weathered basaltic lava. Reddish tropical latosols are the most widespread soils and cover around 70 percent of the whole island. The cultivated area is 106 000 ha, or 52 percent of the total area of Mauritius, of which arable land covers 100 000 ha and permanent crops 6 000 ha (Table 1). Around 20 percent is occupied by built-up areas and 2 percent by public roads. The remaining area consists of forests, scrub lands, grasslands and reservoirs.

TABLE 1
Basic statistics and population

Physical areas:			
Area of the country	2002	204 000	ha
Cultivated area (arable land and area under permanent	2002	106 000	ha
- as % of the total area of the country	2002	52	%
- arable land (annual crops + temp fallow + temp.	2002	100 000	ha
- area under permanent crops	2002	6 000	ha
Population:			
Total population	2004	1 233 000	inhabitants
- of which rural	2004	56	%
Population density	2004	604	inhabitants/km^2
Economically active population	2004	546 000	inhabitants
- as % of total population	2004	44	%
- female	2004	34	%
- male	2004	66	%
Population economically active in agriculture	2004	56 000	inhabitants
- as % of total economically active population	2004	10	%
- female	2004	23	%
- male	2004	77	%
Economy and development:			
Gross Domestic Product (GDP) (current US$)	2003	5 200	million US$/yr
- value added in agriculture (% of GDP)	2003	6.0	%
- GDP per capita	2003	4 259	US$/yr
Human Development Index (highest = 1)	2002	0.785	
Access to improved drinking water sources:			
Total population	2002	100	%
Urban population	2002	100	%
Rural population	2002	100	%

FIGURE 1
Map of Mauritius



FAO - AQUASTAT, 2005

MAURITIUS

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Climate

Mauritius has a sub-tropical and mild maritime climate. There are two seasons: the summer season from December to April, during which temperatures exceed 32 °C on a regular basis, and the winter season from May to November with a minimum temperature seldom falling below 16 °C. The summer is influenced by the passage of cyclones, which cause damage to crops and buildings. The average annual precipitation over the island is 2 041 mm. The north and west of the island are the driest regions of the island, with an annual precipitation of 1 200 mm and 900 mm respectively. The Central Plateau at an altitude of 500 m receives an annual average of 4 000 mm.

Population

Total population of the country is 1.23 million (2004) of which 56 percent are rural (Table 1). Annual population growth rate is 1.1 percent (1990-2002). The population density is 604 inhabitants/km^2. The unemployment rate is 10.6 percent (2003). The total population has access to improved drinking water sources and 99 percent were using adequate sanitation facilities in 2002. Infant mortality rate was 17 per 1000 life births and the under-five mortality rate was 19 per 1000 children in 2002.

ECONOMY, AGRICULTURE AND FOOD SECURITY

In 2003 the Gross Domestic Product (GDP) was US$5.2 billion (current US$). Since achieving independence in 1968, Mauritius has had a practically continuous economic growth at an average rate of 5.2 percent/year (1992-2002). In 2003, agriculture accounted for 6 percent of the GDP. Sugar is the main crop and constitutes the principal agricultural commodity, with an annual production in 2003 of 5.2 million tonnes. Many planters with access to irrigation have diversified from sugar cane to food crops and vegetables, due to the expanded demand from tourism. Basic foodstuffs such as rice, flour and cereals are imported as the cultivation of such commodities is not economically viable in Mauritius.

About 56 000 people or 10 percent of the economically active population work in agriculture, of which 23 percent are women and 77 percent men. About 0.1 percent of adults are estimated to be infected with HIV/AIDS.

WATER RESOURCES

Mauritius consists of 25 major river basins and the largest are the Grand River South East and the Grand River North West. Most rivers are perennial, originating from the central plateau. Discharge to the sea is estimated to be 0.5 km^3/year. Mauritius has five main aquifers. Total renewable water resources are estimated at 2.751 km^3/year (Table 2). Total exploitable water resources are estimated at 1.083 km^3/year.

TABLE 2
Water resources

Renewable water resources:			
Average precipitation		2 041	mm/yr
		4.16	10^9 m^3/yr
Internal renewable water resources		2.75	10^9 m^3/yr
Total actual renewable water resources		2.75	10^9 m^3/yr
Dependency ratio		0	%
Total actual renewable water resources per inhabitant	2004	2 274	m^3/yr
Total dam capacity	2003	93	10^6 m^3

Total dam capacity is 93 million m^3. There are five main storage reservoirs (Mare aux Vacoas, La Ferme, Mare Longue, La Nicoliere, Piton du Milieu) and one impounding rockfill dam (Midlands Dam). Minor reservoirs for hydropower are Tamarin, Eau Bleue and Diamamouve and there are two in-field minor

storage reservoirs at Valetta and Dagotière, which regulate water for irrigation. The amount of treated wastewater was 20.6 million m^3/year in 2002.

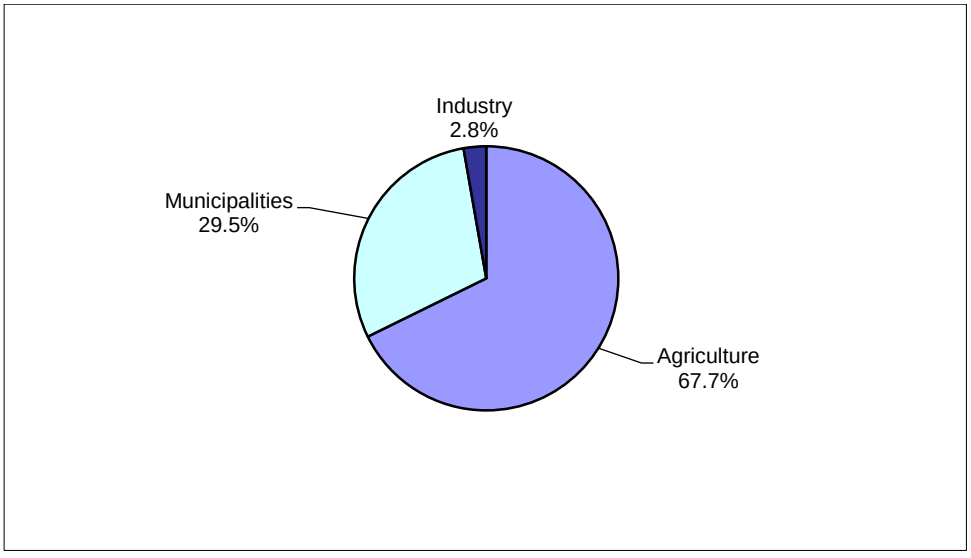
WATER USE

Total water withdrawal in Mauritius is 725 million m^3/year (2003), of which agriculture accounts for 491, municipalities for 214 and industry for 20 million m3/year (Table 3 and Figure 2). The abstraction of groundwater resources amounts to 148 million m3/year, from 360 boreholes, and the remaining abstraction of 577 million m^3/year is surface water. The average depth of the boreholes is 40-60 m, with a maximum depth of 173 m.

TABLE 3
Water uses

Water withdrawal:			
Total water withdrawal	2003	725	10^6 m^3/yr
- irrigation + livestock	2003	491	10^6 m^3/yr
- municipalities	2003	214	10^6 m^3/yr
- industry	2003	20	10^6 m^3/yr
- per inhabitant	2003	599	m^3/yr
Surface water and groundwater withdrawal	2003	725	10^6 m^3/yr
- as % of total actual renewable water resources	2003	26	%
Non-conventional sources of water:			
Produced wastewater		-	10^6 m^3/yr
Treated wastewater	2002	20.65	10^6 m^3/yr
Re-used treated wastewater	2002	0	10^6 m^3/yr
Desalinated water produced	2002	0	10^6 m^3/yr
Re-used agricultural drainage water	2002	0	10^6 m^3/yr

FIGURE 2
Water withdrawal
Total 0.725 km^3 in 2003



IRRIGATION AND DRAINAGE

The irrigation potential in Mauritius is estimated at 33 000 ha. The development of irrigation started in 1910 with the construction of the La Ferme and Nicolière reservoirs and the main feeder canals in 1929 to convey water to the western and northern regions. Surface irrigation was used until the early 1960s when sprinkler irrigation was introduced. In 1970, the areas equipped for full and partial control irrigation were about 12 000 ha, all for sugar cane. In 1978 the Mauritius Irrigation Authority was

created, which accelerated the expansion of the irrigation sector for sugar cane and food crops and promoted the adoption of efficient irrigation techniques. Mauritius has one of the highest yields of sugar cane in the world. The area equipped for full control irrigation was estimated to be 16 720 ha in 1987, 17 500 ha in 1995 and 21 222 ha in 2003. Surface irrigation is practised on 2 372 ha, sprinkler irrigation on 17 028 ha and localized irrigation on 1 822 ha (Table 4 and Figure 3). About 75 percent of the land is irrigated with surface water and 25 percent by groundwater (Figure 4). Around 61 percent of the land is power irrigated. Most of the area equipped for irrigation is actually irrigated, i.e. 20 800 ha. Three categories of irrigation schemes can be distinguished: i) small-scale irrigation schemes (< 2 ha) amounting to 4 548 ha; ii) medium-scale irrigation schemes (2-40 ha) amounting to 328 ha and iii) large-scale irrigation schemes (> 40 ha) amounting to 16 346 ha (Table 4 and Figure 5).

TABLE 4
Irrigation and drainage

Irrigation potential			33 000	ha
Water management				
1. Full or partial control irrigation: equipped area		2002	21 222	ha
- surface irrigation		2002	2 372	ha
- sprinkler irrigation		2002	17 028	ha
- localized irrigation		2002	1 822	ha
- % of area irrigated from groundwater		2002	25	%
- % of area irrigated from surface water		2002	75	%
2. Equipped lowlands (wetland, ivb, flood plains, mangroves)		2002	0	ha
3. Spate irrigation		2002	0	ha
Total area equipped for irrigation (1+2+3)		2002	**21 222**	**ha**
- as % of cultivated area		2002	20	%
- average increase per year over the last 7 years		1995-2002	2.8	%
- power irrigated area as % of total area equipped		2002	61	%
- % of total area equipped actually irrigated		2002	98	%
4. Non-equipped cultivated wetlands and inland valley bottoms		2002	0	
5. Non-equipped flood recession cropping area		2002	0	ha
Total water-managed area (1+2+3+4+5)		2002	**21 222**	**ha**
- as % of cultivated area		2002	20	%
Full or partial control irrigation schemes:	**Criteria**:			
Small-scale schemes	< 2 ha	2002	4 548	ha
Medium-scale schemes	2–40 ha	2002	328	ha
Large-scale schemes	> 40 ha	2002	16 346	ha
Total number of households in irrigation			-	
Irrigated crops in full or partial control irrigation schemes:				
Total irrigated grain production		2002	295	tons
- as % of total grain production		2002	100	%
Total harvested irrigated cropped area		2002	20 919	ha
- Annual crops: total		2002	20 877	ha
. maize		2002	38	ha
. sugarcane		2002	19 490	ha
. vegetables		2002	758	ha
. tobacco		2002	340	ha
. groundnuts		2002	116	ha
. flowers		2002	135	ha
- Permanent crops: total		2002	42	ha
. citrus		2002	42	ha
Irrigated cropping intensity		2002	101	%
Drainage - Environment:				
Total drained area			-	ha
- part of the area equipped for irrigation drained			-	ha
- other drained area (non-irrigated)			-	ha
- drained area as % of cultivated area			-	%
Flood-protected areas			-	ha
Area salinized by irrigation			-	ha
Population affected by water-related diseases			-	inhabitants

FIGURE 3
Irrigation techniques
Total 21 222 ha in 2002

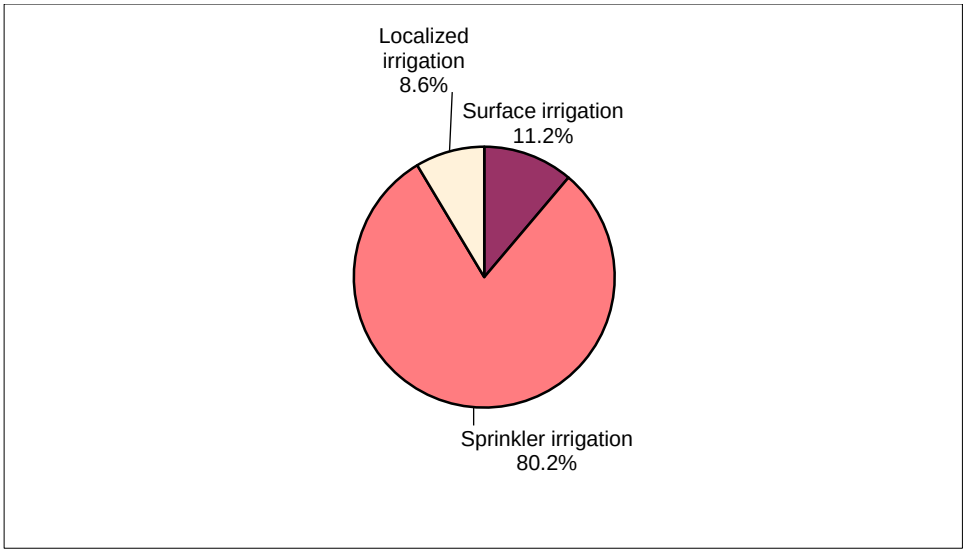


FIGURE 4
Origin of irrigation water
Total 21 222 ha in 2002

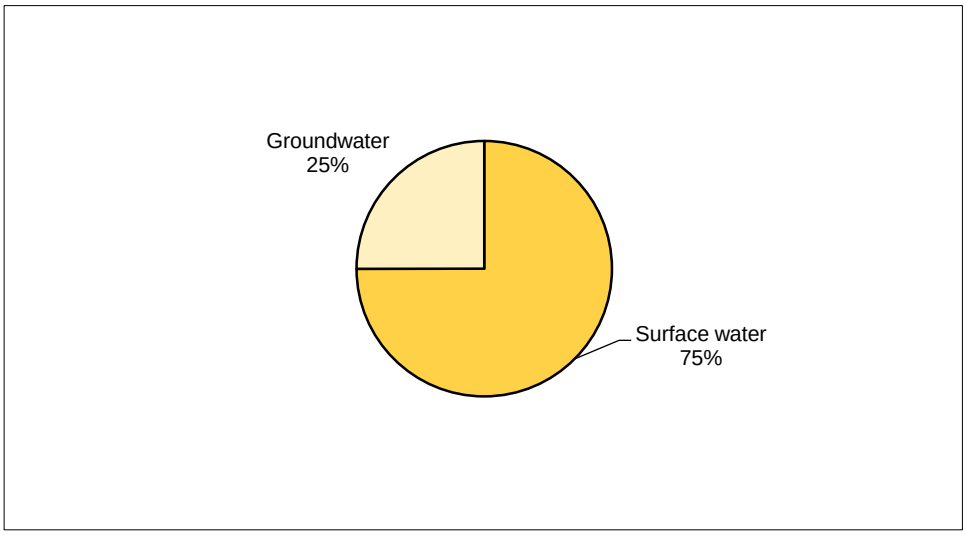
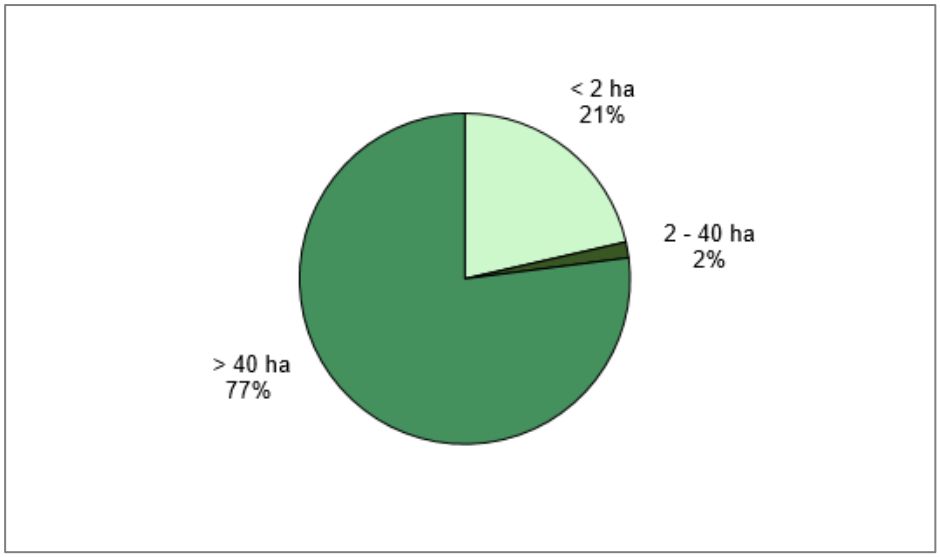


FIGURE 5
Typology of irrigation
Total 21 222 ha in 2002

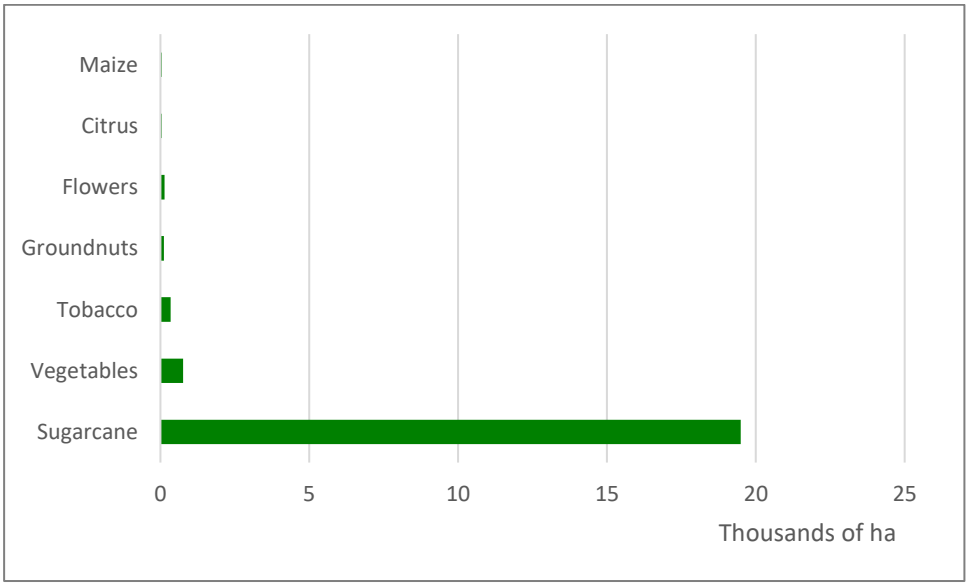


Both public and private irrigation schemes exist. In private schemes, the farmers own the land and are beneficiaries of water rights for surface water or groundwater. Irrigation construction, operation and maintenance are financed by them too. In public schemes, the land is either owned by the farmers or it belongs to the state. Full or up to 80 percent of the investment is made by the state, which has the water rights. Operation and maintenance costs are covered by the Water Users' Association (WUA).

Role of irrigation in agricultural production, the economy and society

Most of the irrigation schemes operational at present are located in the rural areas in the northern and western regions and in the coastal belts of east and south. Farmers have diversified their agriculture from the mono-crop of sugar cane to food crops such as vegetables (tomatoes, eggplants, green peppers, and beans) (Table 4 and Figure 6).

FIGURE 6
Irrigated crops
Total 20 919 ha in 2002 (cropping intensity: 101%)



The development cost of irrigation for public schemes is US$10 200/ha for centre pivot-cum-solid set high-pressure sprinkler irrigation, US$8 653/ha for drip irrigation and US$3 845/ha for dragline low pressure sprinkler irrigation. The average operational and maintenance costs are US$506/ha and rehabilitation costs around US$290/ha in public schemes. The average cost of irrigation development in private schemes is US$7 590/ha for centre pivot irrigation, with operational and maintenance costs of US$318/ha and rehabilitation costs of US$254/ha. Annual irrigation water requirements for sugar cane vary from region to region, being on average around 820 mm in the north, 1100 mm in the west and 700 mm in the east and west.

The WUAs are constituted of male members who organize water distribution and collect water charges. Activities such as starting the pumps in the pumping stations, fertilizer injection in the drip system, and minor maintenance are confined to men. Women participate in the opening of hydrant valves, in the displacement of low-pressure sprinklers or flushing of drippers, and are attending the meetings of the WUA.

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

Institutions

The main institutions involved in the irrigation and water sub-sectors are:

- The Central Water Authority (CWA) under the Ministry of Public Utilities. The CWA is the premier institution created, in 1971. It is responsible for the control, development and conservation of water resources as well as distribution of water to the industrial and municipal (including tourist) sectors.
- The Water Resources Unit (WRU) under the Ministry of Public Utilities. The WRU is responsible for the coordination of all activities concerning water resources management, water rights, licensing and control of water user permits.
- The Irrigation Authority (IA), created in 1979. Its aim is to study the development of irrigation and prepare irrigation schemes for specific areas, to implement and manage irrigation projects and to undertake research on optimum water use.

Water management

Water allocation for all different sectors, including agriculture, is determined by a High Powered Committee comprising all stakeholders in the water sector. Water requirements are computed every month for planning water releases from the reservoirs. Groundwater levels are monitored by the WRU, which also imposes restrictions during the dry months to avoid over-pumping. Farmers in public irrigation schemes group themselves into WUAs or Water Users' Cooperative Societies (WUCS) under the Registrar of association act or the Cooperative act respectively. The Irrigation Authority has a Transfer Management Agreement with the WUA or WUCS where day-to-day operation is entrusted to the association or society.

Finances

The State undertakes capital investment in the implementation of public irrigation schemes. However, recently the beneficiaries have been encouraged to participate in contributing towards the purchase and installation of the field equipment. With the implementation of Participatory Irrigation Management, the WUAs are called upon to take full control of day-to-day operation. For the implementation of private schemes, agricultural loans are available from the state owned Development Bank of Mauritius at a rate of 8 percent. Farmers are at present billed annually on the basis of the cropped area. For the future it is envisaged to levy large planters on the basis of volume of water abstracted.

Policies and legislation

The Policies Plan hinges on a four-pronged approach:

- Upgrading and consolidation of the conveyance system, mobilization of additional water resources by the construction of dams and drilling of deep boreholes and adoption of efficient irrigation techniques (sprinkler or drip) for the expansion of the irrigation sector.
- Formation and training of the WUAs in order to encourage participation in irrigation management.
- Application of a sound water tariff for irrigation to render schemes economically viable and socially acceptable.
- Reinforcement of the legal framework (River Canal Act and Groundwater Act) for an equitable distribution of water and its judicious use.

Water supply for irrigation is regulated by the River and Canal Act of 1863, the Groundwater Act of 1970 and the Irrigation Authority Act of 1979. Abstraction of water from rivers requires a water right duly granted by the Supreme Court. The WRU recommends water rights for applicants. For groundwater abstraction, drilling a borehole requires authorization from the WRU. The amount of water allowed to be withdrawn over a specific period is part of the Groundwater License.

ENVIRONMENT AND HEALTH

Agrochemical usage (pesticides and fertilizers) in Mauritius is linked primarily to the intensive cultivation of sugar cane and some 7 000 ha under food crops and vegetables. For control of weeds in sugar cane, about 630 tonnes of herbicides are applied annually, the major ones being divron, atrazine and 2-41. The application rate of fertilizer is within the limit of 600 kg/ha. Today there is no risk of groundwater pollution from fertilizers and the nitrate concentration in groundwater is well below WHO threshold values. Waterlogging and salinization is normally not a problem in Mauritius.

The coastal areas in the north and east are subjected to seawater intrusion, particularly during drought periods when the aquifers are depressed. The water quality from reservoirs and boreholes is suitable for overhead irrigation. For drip irrigation water has to be filtered from algae and suspended solids before being distributed.

PROSPECTS FOR AGRICULTURAL WATER MANAGEMENT

The agricultural sector today has to compete with the municipal (including tourism) and industrial sectors for access to water. Due to uncertainties in the export price for sugar cane to the EC, diversification into cash crops has become an incentive for raising revenue. Due to a constant rehabilitation program there is no abandoned irrigation infrastructure. Efforts are being geared to modernizing and making irrigation systems efficient.

Whereas the state is committed to mobilizing water resources, the construction of the infield irrigation infrastructure should be undertaken and financed by WUAs which are required to decide for themselves on matters of irrigation systems and operational practices.

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