

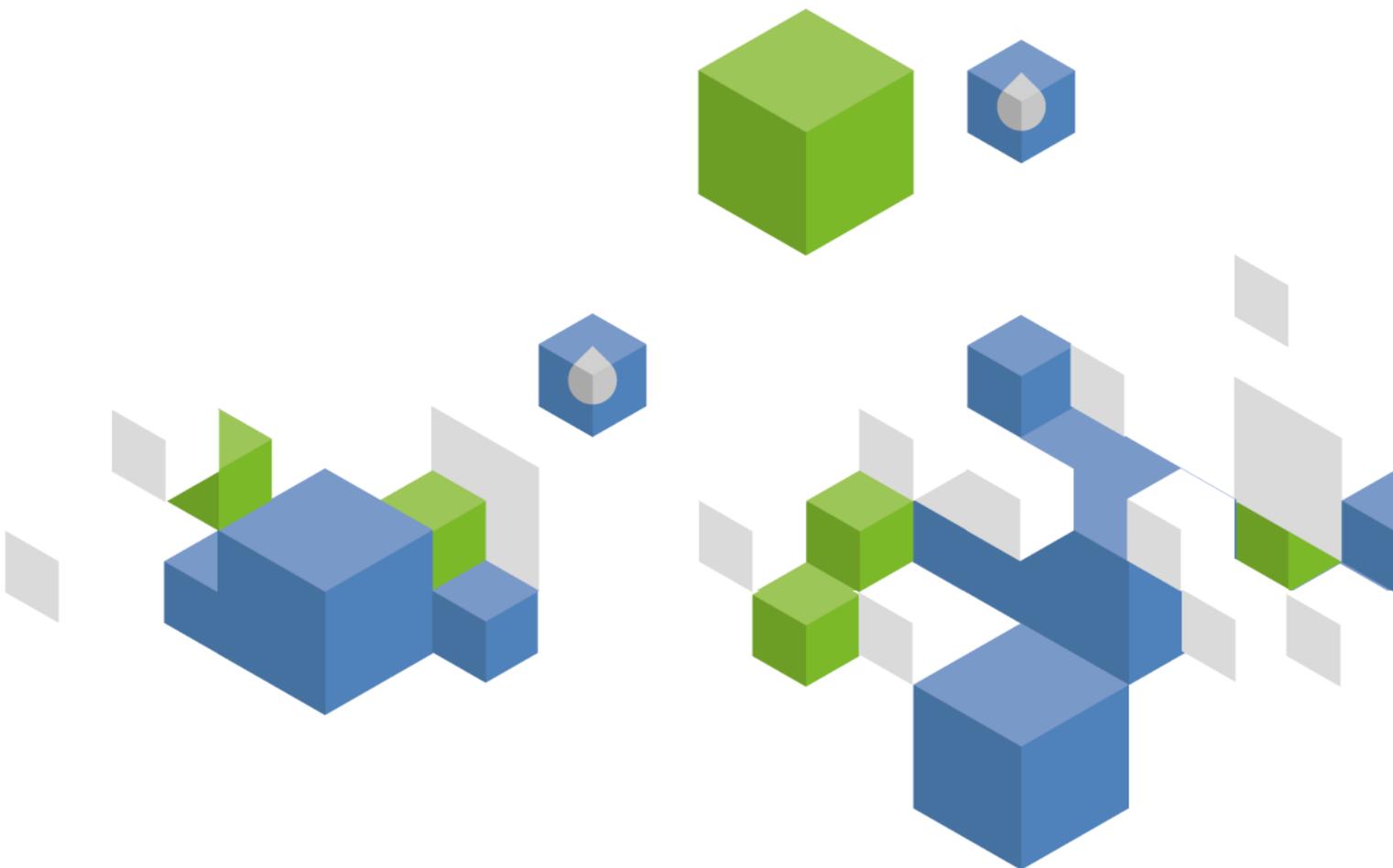


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Antigua and Barbuda

GEOGRAPHY, CLIMATE AND POPULATION

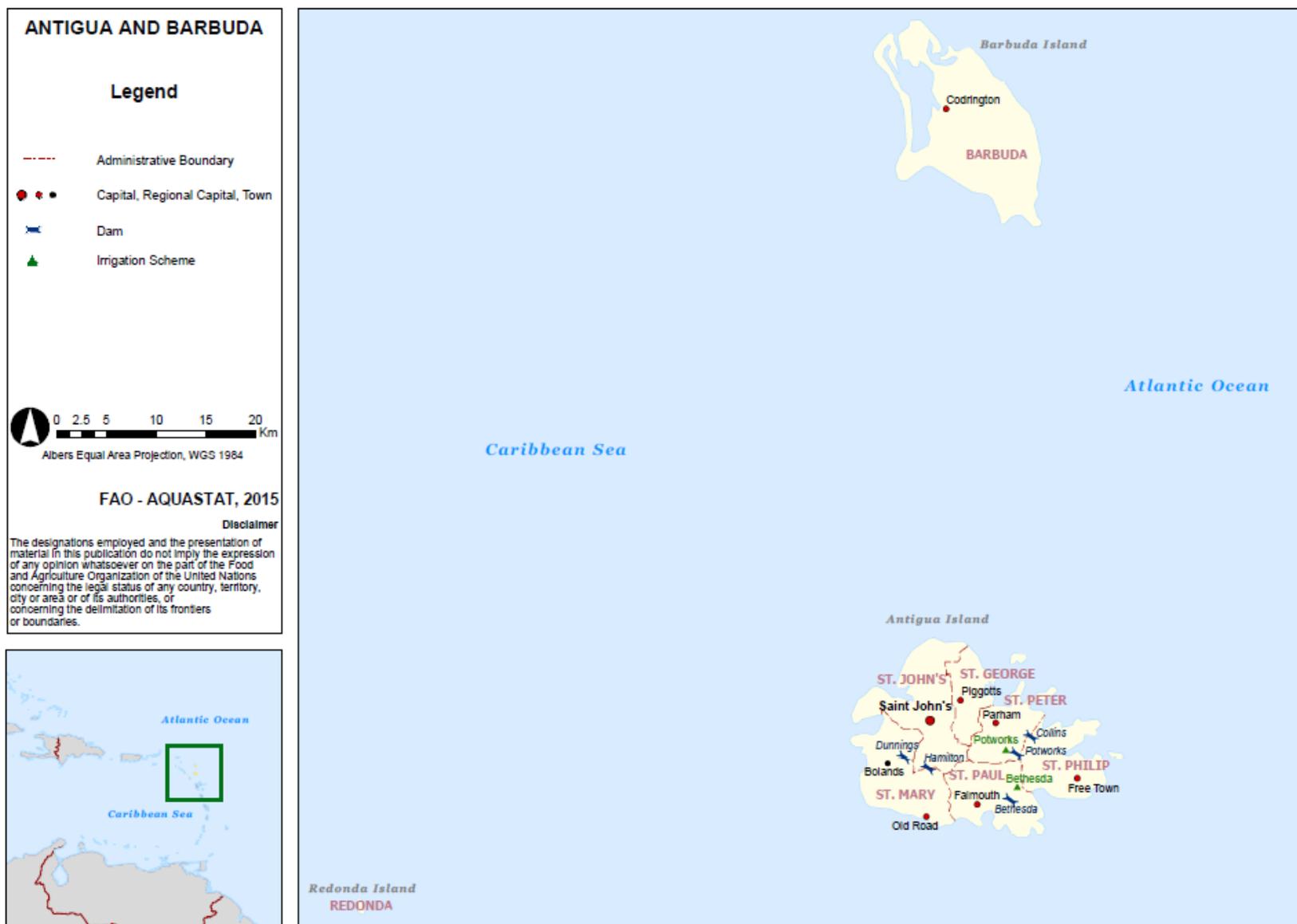
Geography

The twin island state of Antigua and Barbuda is situated in the northeastern part of the Leeward Islands of the Lesser Antilles. The islands are located between 17°00' and 17°35'N latitude and between 61°40' and 61°55'W longitude. Total land area is 440 km², Antigua being the larger island with an area of 280 km² and Barbuda having an area of 160 km². Approximately 31 percent of the total land area (13 810 ha) is considered cultivable. In 2012, the total physical cultivated area was estimated at 5 000 ha, of which 4 000 ha were temporary crops and 1 000 ha were permanent crops (Table 1). Permanent meadows and pasture occupied 4 000 ha, bringing the agricultural land area to 9 000 ha. Antigua and Barbuda is politically divided into six parishes (Saint George, Saint John's, Saint Mary, Saint Paul, Saint Peter and Saint Philip) and two dependencies (Barbuda and Redonda).

TABLE 1
Basic statistics and population

Physical areas:			
Area of the country	2012	44 000	ha
Agricultural land (permanent meadows and pasture + cultivated land)	2012	9 000	ha
• As % of the total area of the country	2012	20	%
• Permanent meadows and pasture	2012	4 000	ha
• Cultivated area (arable land + area under permanent crops)	2012	5 000	ha
- As % of the total area of the country	2012	11	%
- Arable land (temp. crops + temp. fallow + temp. meadows)	2012	4 000	ha
- Area under permanent crops	2012	1 000	ha
Population:			
Total population	2013	90 000	inhabitants
- Of which rural	2013	70	%
Population density	2013	205	inhabitants/km ²
Population economically active	2013	39 000	inhabitants
• As % of total population	2013	43	%
• Female	2013	44	%
• Male	2013	56	%
Population economically active in agriculture	2013	8 000	inhabitants
• As % of total economically active population	2013	21	%
• Female	2013	25	%
• Male	2013	75	%
Economy and development:			
Gross Domestic Product (GDP) (current US\$)	2013	1 230	million US\$/year
• Value added in agriculture (% of GDP)	2012	2	%
• GDP per capita	2013	13 667	US\$/year
Human Development Index (highest = 1)	2013	0.774	-
Gender Inequality Index (equality = 0, inequality = 1)	-	-	-
Access to improved drinking water sources:			
Total population	2012	98	%
Urban population	2012	98	%
Rural population	2012	98	%

FIGURE 1
Map of Antigua and Barbuda



There are three main agro-ecological zones in Antigua: (i) the North-Eastern Limestone Formation, (ii) the Central Plains, which is mixed volcanic and sedimentary/mudstone together with alluvial area, and (iii) the Volcanic Region. The highest peak in Antigua is Boggy Park (403 m). Barbuda by contrast is coralline and flat. Its highest peak, Highlands, is only 38 m. above sea level.

Climate

Antigua and Barbuda both experience a tropical maritime climate with little variation in daily or seasonal temperatures. Average monthly minimum temperatures range from 22°C in February to 25°C in August, while monthly maximum temperatures range from 28°C in February to 31°C in September. Somewhat greater diurnal variation is observed in some inland areas (UNCCD, 2005).

Average annual precipitation of the country is 1 030 mm, ranging from 667 mm to 1 708 mm. The driest period of the year is from January to April, while the wet season is from September to November. These months coincide with the period of active tropical waves and tropical storms.

Droughts occur every five to ten years. When several low-rainfall years occur consecutively, the country faces critical water shortages. Conversely, depending on the major climatic cycles associated with El Nino/La Nina, quite wet years are also possible.

Population

In 2013, the total population was about 90 000 inhabitants, of which around 98 percent in Antigua and 2 percent in Barbuda. Of the total population of both islands 70 percent is rural (Table 1). Population density is 205 inhabitants/km². The average annual population growth rate in the 2003-2013 period is 1.1 percent.

In 2012, 98 percent of the total population had access to improved water sources (both in urban and rural areas) and 91 percent of the total population had access to improved sanitation (also both in urban and rural areas).

ECONOMY, AGRICULTURE AND FOOD SECURITY

In 2013, the Gross Domestic Product (GDP) was US\$ 1 230 million and agriculture accounted for only 2 percent of GDP compared to 40 percent prior to the 1960s and the subsequent collapse of the sugar industry. The service industry/tourism is now the major foreign exchange earner, contributing 81 percent of GDP. Nevertheless, despite its small contribution to GDP, the agricultural sector still is one of the largest employers. In 2013, total population economically active in agriculture is estimated at 8 000 inhabitants (21 percent of economically active population), of which 25 percent is female and 75 percent is male.

Sugar is still cultivated, and other vegetable and fruit crops are grown on small farms, but Sea Island cotton is the only profitable export crop. The agricultural sector has been constrained by high labour costs, small size of local market, lack of marketing structures and infrastructure, competition from imported foodstuffs, and inadequate water supplies for irrigation as well as a regular succession of severe droughts and destructive hurricanes, and limited land tenure rights.

Agriculture is dominated by livestock production with goats being the dominant specie. More than 75 percent of livestock production of Antigua is carried out in the Central Plains and the North-Eastern Limestone Formation. Barbuda is devoted entirely to livestock production with the exception of a few agricultural stations and fenced farming areas.

WATER RESOURCES

Surface water resources, groundwater resources and non-conventional sources of water

The total average rainfall for both islands is estimated at 453 million m³/year and renewable water resources are estimated at about 52 million m³/year (Table 2). There are no perennial rivers in the country, only intermittent rivers where water flows during part of the year, which then can also be stored in ponds and reservoirs. At present the country's agricultural and municipal (domestic and commercial) water demands are being met by four desalination plants, two surface water treatment plants, numerous small ponds and five well fields.

TABLE 2
Renewable water resources

Renewable freshwater resources:			
Precipitation (long-term average)	-	1 030	mm/year
	-	453	million m ³ /year
Internal renewable water resources (long-term average)	-	52	million m ³ /year
Total renewable water resources	-	52	million m ³ /year
Dependency ratio	-	0	%
Total renewable water resources per inhabitant	2013	578	m ³ /year
Total dam capacity	2013	6	million m ³

In Antigua, with a population of about 88 000 people, there are approximately 43 active wells with major well fields located in the Bendals Valley, Bolands and Collins areas. The island has three Reverse Osmosis (RO) desalination plants/systems, the Sembcorp Plant (5.1 million m³/year), the Camp Blizzard Plant (1.0 million m³/year) and the Ffryes Beach Plant (1.0 million m³/year), with a total desalination capacity of approximately 7.1 million m³/year. The Antigua Public Utilities Authority (APUA) tries to rely on surface water and groundwater as much as possible given the inexpensive nature of its production. As a drought prone island, relying on surface water and groundwater often becomes difficult, this creates the need for reverse osmosis. Antigua has two water treatment plants with a total volume of 3.7 million m³, of which Delapps plant accounts for 2.5 million m³ and Bendals plant accounts for 1.2 million m³ (APUA, 2012).

In Barbuda, with a population of less than 2 000 people, most of the water supplied to the population comes from shallow wells. In 2005, the water obtained from wells in the Palmetto Point area was potable but other wells around the island have been found to be saline in content. APUA then installed a Reverse Osmosis (RO) Plant in Barbuda which produces approximately 113.6 m³/day or 0.041 million m³/year to meet the needs of the residents of Barbuda.

Harvesting of rainwater by households contributes an important source of safe drinking water provided the collection and storage system is kept in a hygienically good condition. By law, all new houses are supposed to be equipped with rainwater collection and storage systems. The average size of this storage is 19 m³ and the number of households is approximately 20 000.

Dams

Antigua has about 18 medium to small reservoirs and about 550 ponds and earth dams. The total combined capacity of all reservoirs, ponds and mini-dams is approximately 6 million m³ in 2013.

Reservoirs for agricultural purposes have a total capacity of 1 016 000 m³. The main ones are at Bethesda (537 000 m³), ASF Dams (116 000 m³), Langfords (110 000 m³), Gunthorpes (93 000 m³), Red hill (46 000 m³) and Bendals (23 000 m³).

Reservoirs for municipal purposes have a total capacity of 4 976 480 m³. The main ones are at Potworks (4 142 000 m³), Collins (342 000 m³), Dunning (136 040 m³), Hamilton (104 120 m³), Body Pond (101 460 m³). Collins is not used directly – a number of wells were drilled around it and it provides

groundwater recharge for them. Body Pond was destroyed by Hurricane Louis in 1995 and the government is seeking funds to have it rebuilt.

The Fig Tree and Wallings dams are not used by the Water Business Unit. Both provide recreational and nature trail ambiance to persons who visit the area.

It is estimated that there are over 550 ponds, each with capacity less than 1 000 m³. The small ponds are used primarily for agriculture.

Most of the ponds and dams are privately owned and are not under the control of the Ministry of Agriculture, Lands, and Housing and the Environment (MALHE) or APUA.

During drier months irrigation is restricted to a very limited area due to shortfall in surface water and groundwater yields, and most surface water storage is diverted to municipal supply. Barbuda's topography and geology are not well suited to dam construction.

WATER USE

Annual water withdrawal in 1990 was about 5 million m³, of which the municipal sector accounted for 60 percent and agriculture and industry accounted for 20 percent each.

In 2005, annual water withdrawal was about 8.4 million m³, of which the municipal sector accounted for 5.3 million m³ or 63 percent, the industrial sector accounted for 1.8 million m³ or 21 percent and the agricultural sector accounted for 1.3 million m³ or 16 percent.

In 2012, water withdrawal is estimated at 11.5 million m³, of which the municipal sector accounted for 7.2 million m³ or 63 percent, the industrial sector accounted for 2.5 million m³ or 22 percent and the agricultural sector accounted for 1.8 million m³ or 15 percent (Figure 2 and Table 3).

FIGURE 2
Water withdrawal by sector
Total 11.5 million m³ in 2012

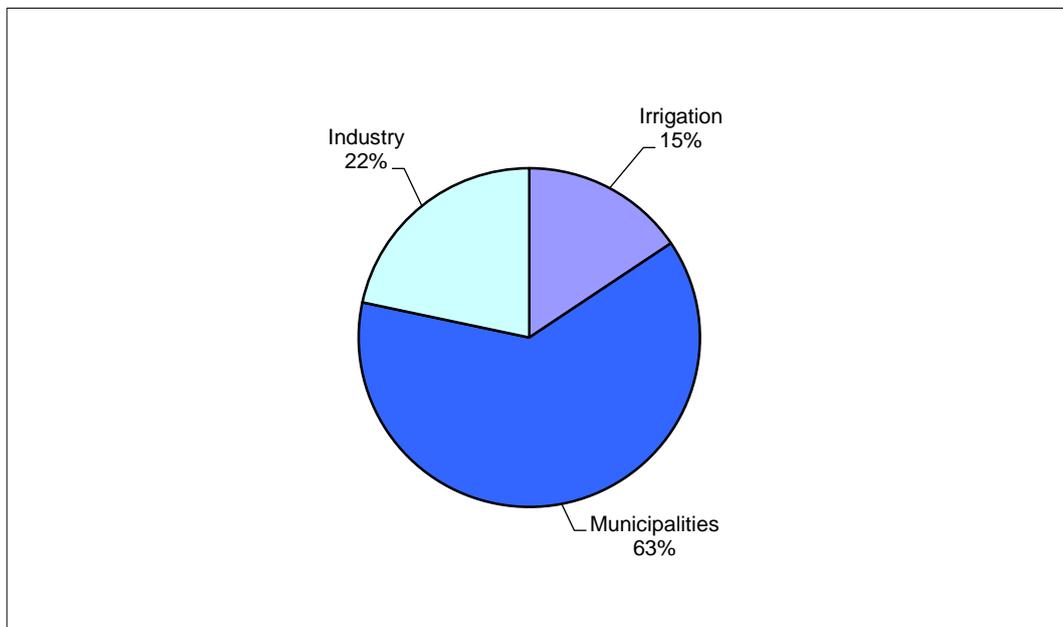


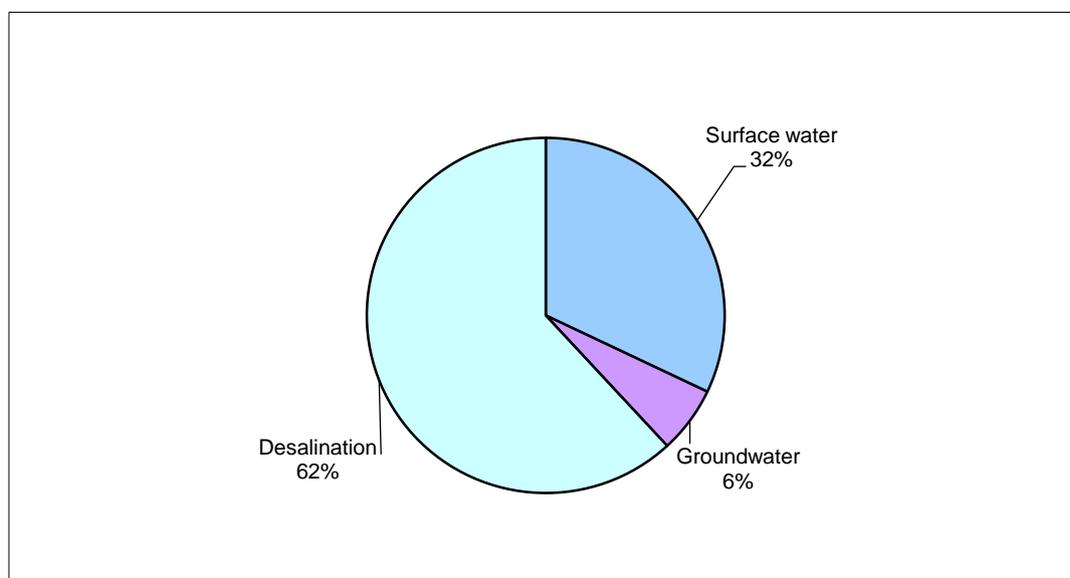
TABLE 3
Water use

Water withdrawal:			
Total water withdrawal	2012	11.5	million m ³ /year
- Agriculture (Irrigation + Livestock + Aquaculture)	2012	1.8	million m ³ /year
- Municipalities	2012	7.2	million m ³ /year
- Industry	2012	2.5	million m ³ /year
• Per inhabitant	2012	117	m ³ /year
Surface water and groundwater withdrawal (primary and secondary)	2012	4.4	million m ³ /year
• As % of total actual renewable water resources	2012	8	%
Non-conventional sources of water:			
Produced municipal wastewater	-	-	million m ³ /year
Treated municipal wastewater	1990	0.2	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	2012	7.1	million m ³ /year

The sources of water in Antigua are as follows (Figure 3):

- Reverse osmosis plants: 7.1 million m³, or 62 percent of total, of which 5.1 million m³ by Sembcorp, 1.0 million m³ by APUA Camp Blizzard plant, and 1.0 million m³ by Ffryes Beach reverse osmosis plant.
- Water treatment plants: 3.7 million m³, or 32 percent of total, of which 2.5 million m³ by Delapps water treatment plant and 1.2 million m³ by Bendals water treatment plant. This water is partly used directly and partly stored as secondary freshwater in the reservoirs together with primary freshwater.
- Groundwater: 0.7 million m³, or 6 percent of total.

FIGURE 3
Water withdrawal by source
Total 11.5 million m³ in 2012



Barbuda produces approximately 0.041 million m³/year of desalination water to meet the needs of the residents of Barbuda.

IRRIGATION AND DRAINAGE

Evolution of irrigation development

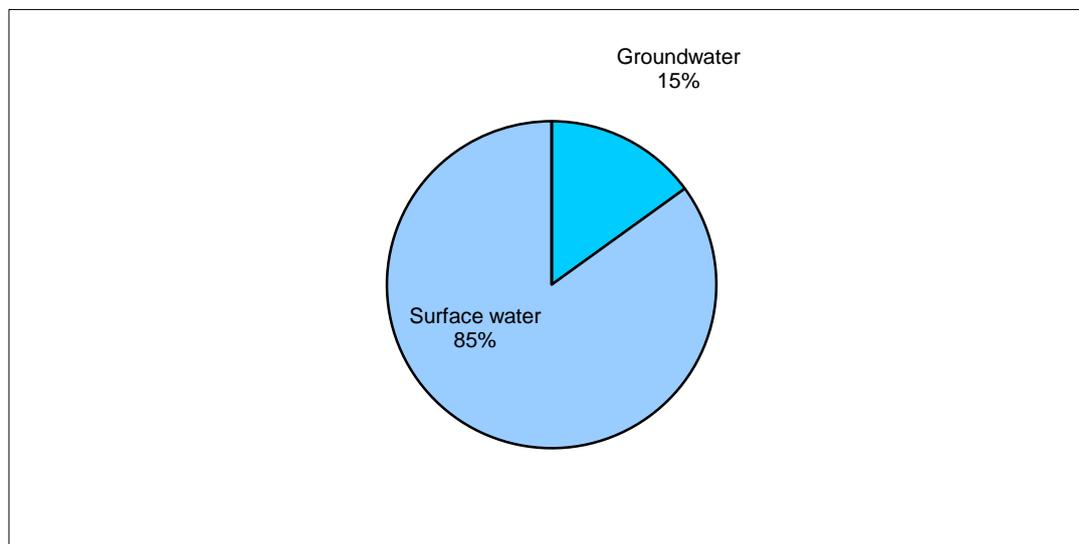
In 2014, 384.5 ha are equipped for irrigation and actually irrigated in Antigua and Barbuda. Localized irrigation is the only technology used (Table 4).

TABLE 4
Irrigation and drainage

Irrigation potential	-	-	ha
Irrigation:			
1. Full control irrigation: equipped area	2014	384.5	ha
- Surface irrigation	-	0	ha
- Sprinkler irrigation	-	0	ha
- Localized irrigation	2014	384.5	ha
• Area equipped for full control irrigation actually irrigated	2014	384.5	ha
- As % of area equipped for full control irrigation	2014	100	%
2. Equipped lowlands (wetland, ivb, flood plains, mangroves)	-	-	ha
3. Spate irrigation	-	-	ha
Total area equipped for irrigation (1+2+3)	2014	384.5	ha
• As % of cultivated area	2014	8	%
• % of area irrigated from surface water	1997	85	%
• % of area irrigated from groundwater	1997	15	%
• % of area irrigated from mixed surface water and groundwater	-	-	%
• % of area irrigated from non-conventional sources of water	-	-	%
• Area equipped for irrigation actually irrigated	2014	384.5	ha
- As % of total area equipped for irrigation	2014	100	%
• Average increase per year	1997 - 2014	6.6	%
• 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 agricultural water managed area (1+2+3+4+5)	2014	384.5	Ha
• As % of cultivated area	2014	8	%
Size of full control irrigation schemes: Criteria:			
Small schemes	< - ha	-	ha
Medium schemes	> - ha and < - ha	-	ha
Large schemes	> - ha	-	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	2014	384.5	ha
• Temporary crops: total	2014	283.3	ha
- Vegetables	2014	283.3	ha
• Permanent crops: total	2014	101.2	ha
- Fruits	2014	101.2	ha
Irrigated cropping intensity (on full control area actually irrigated)	2014	100	%
Drainage - Environment:			
Total cultivated area drained	1997	808	ha
• Non-irrigated cultivated area drained	-	-	ha
• Area equipped for irrigation drained	-	-	ha
- As % of total area equipped for irrigation	-	-	%
Area salinized by irrigation	-	-	ha
Area waterlogged by irrigation	-	-	ha

Surface supplies are the main source of irrigation water for agriculture, with occasional use of groundwater when municipal demands allow (Figure 4).

FIGURE 4
Source of irrigation water
 Total 130 ha in 1997

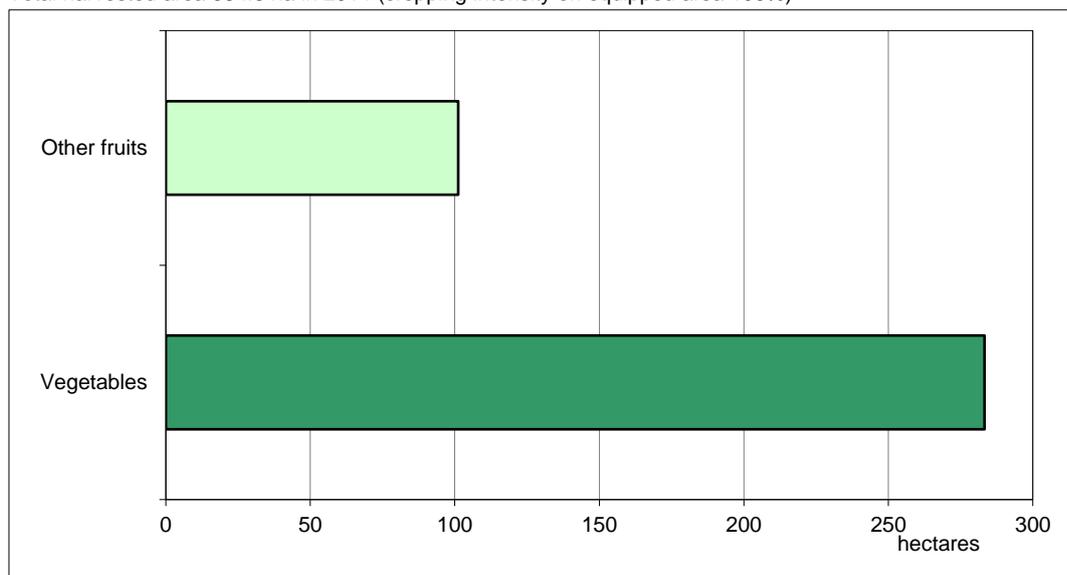


Government-owned irrigation schemes in Antigua are the Sanderson, Bethesda and Potworks irrigation projects. The Sanderson scheme is the smallest with a size of 8 ha, serving 10 households. The second largest scheme is at Bethesda, serving 10 households. The Potworks scheme is the largest, extending some 50 ha, serving 15 households. All three irrigation schemes service farms which are each 1 ha or less in size.

Role of irrigation in agricultural production, economy and society

In 2014, of a total harvested irrigated crop area of 384.5 ha, 74 percent consisted of vegetables, such as tomatoes, onions, cucumbers, water melon and cabbage, and 26 percent consisted of fruits (Table 4 and Figure 5).

FIGURE 5
Irrigated crops
 Total harvested area 384.5 ha in 2014 (cropping intensity on equipped area 100%)



Women and irrigation

Women have limited access to and control over the resources of production in Antigua and Barbuda that makes them more vulnerable to poverty. They utilize farming to fulfil the basic needs of their families. While the Ministry of Lands and Agriculture does not maintain sex-disaggregated data on land ownership, it is understood that women in the country participate more extensively in agricultural production. However, the actual participation of women in farming and agriculture may be underestimated (CDB, 2014).

Status and evolution of drainage systems

In 1997, the drained surface area was about 808 ha and was limited to on-farm drains constructed to dispose of excess rainfall and downhill runoff (Table 4).

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

Institutions

All water resources of Antigua and Barbuda are currently vested in the Antigua Public Utilities Authority (APUA). APUA operates a network of distribution pipes throughout the country to supply treated water to both domestic and commercial sectors. Agriculture is considered to be a commercial activity and irrigation generally does not enjoy any special preference in water allocation.

The Ministry of Agriculture, Lands, and Housing and the Environment (MALHE), former Ministry of Agriculture, Lands, Fisheries and Housing (MALFH), is responsible for technical assistance to farmers on irrigation, drainage, soil and water conservation.

The Caribbean Agricultural Research and Development Institute (CARDI) provides technical assistance and training in soil and water conservation to the MALHE and farmers in collaboration with the Extension Division and under the Natural Resources Management Programme.

Private sector companies such as hotels and recreation facilities (golf courses) employ local and expatriate personnel for irrigation operation and maintenance.

Water management

The current tenure system deters farmers from investing in needed infrastructure to ensure continuous water supplies or marketing systems. Government land policies have helped to keep farms small, with insecure land tenure and plots separated from the farmer's home. Most of the cultivated land is under government control following the demise of the sugar industry, and farmers typically rent land from the government, usually for periods of up to five years, with little security of tenure. This discourages long-term investments in soil and water conservation techniques needed to expand the sector and enhance productivity. Many smaller holdings suffer from limited groundwater availability, droughts and insect pests, or unfertile depleted soils.

The APUA has a long-term water development plan with emphasis on desalinization of seawater to eliminate the risk of drought and inadequate surface storage and groundwater facilities.

Finances

There is no charge for the use of irrigation water obtained from dams or ponds. Where irrigation water is obtained from the municipal water supply, the user is charged.

Policies and legislation

There are 46 separate pieces of legislation related to water supply management, directly as land use, water and waste management laws or indirectly as protected areas, forestry and agriculture laws. Many of these laws, such as the Watercourses and Waterworks Ordinances of 1945, last amended in 1953, need to be updated (OAS, 2005).

ENVIRONMENT AND HEALTH

Centuries of unsustainable agricultural practices, particularly those related to the sugar industry, have reduced the fertility of the limited agricultural land and primed soil erosion trends. Overall, production is good for a country with poor soil quality, low annual rainfall in certain areas and very limited access to international markets. However, pollution from inorganic fertilizers and pesticides occurs due to high levels of application and there is no adequate monitoring of impacts. Integrated pest management is a national government policy, but inadequate funding has constrained implementation.

Vegetative cover is also affected by the traditional use of fires to clear and prepare land. The issue of uncontrolled fires is compounded by the invasive Lemon Grass species that were introduced in the 1960s to control soil erosion, but it has spread over vast tracts of land in several of the main catchment areas and is now a major factor contributing to soil erosion.

Livestock production is characterized by unsustainable practices. Uncontrolled grazing of livestock (sheep, goats, donkeys and cattle) affects vegetative cover. This is widely perceived as one of the country's leading environmental problems.

PROSPECTS FOR AGRICULTURAL WATER MANAGEMENT

Climate change could bring a decrease in water availability and a greater vulnerability to natural hazards with the corresponding problems for the water resource management (OAS, 2005).

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