

Evolution of territorial issues and uses linked to the Manzo dam (Martinique, France)

Valéry Veilleur¹, Collectivité Territoriale de Martinique

Johanna Chalonec², AgroParisTech

Ronny Rosillette¹, Collectivité Territoriale de Martinique

Laurent Peyras³, INRAE

Background



Martinique,
1152 km²
French Caribbean island

Background

Martinique in the 1960's-1970's :

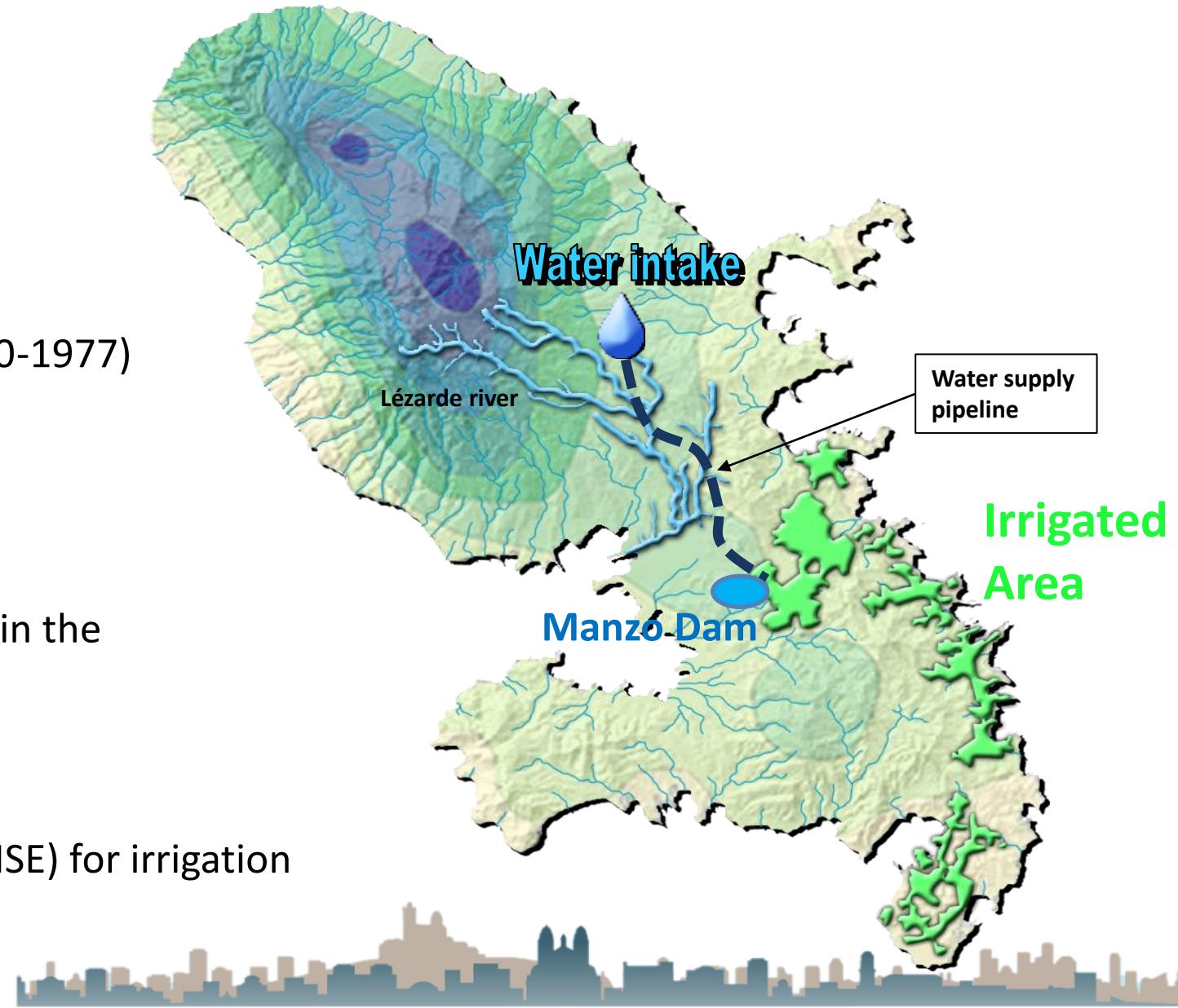
- ❖ Deep social and economic crisis
- ❖ Increasing population emigration
- ❖ Recurrent droughts in the South East (1970-1977)
- ❖ ↳ 15% regional agricultural production



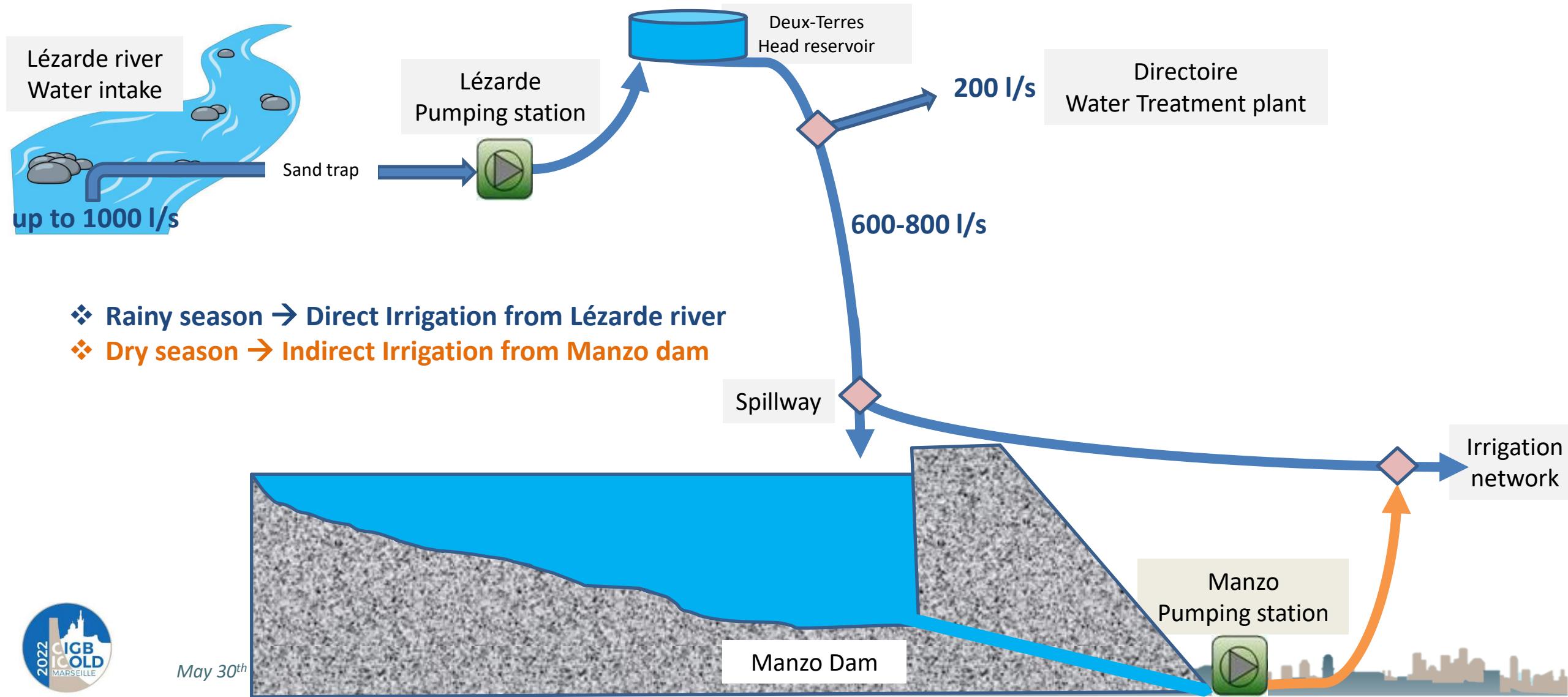
- ❖ Ensure water availability all over the year in the South East for economic development



- ❖ 1980 : **Hydraulic infrastructure project (PISE) for irrigation**

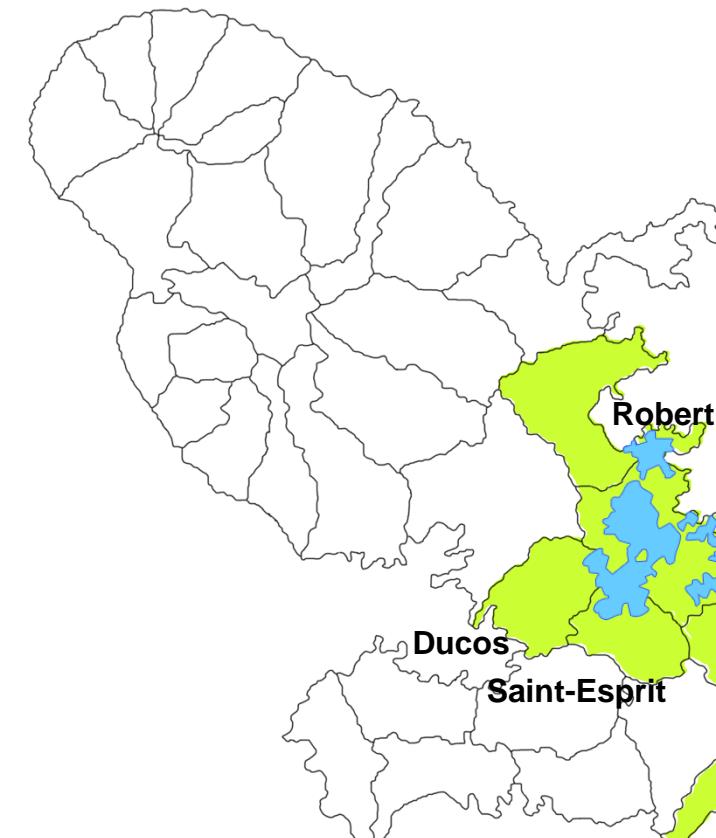


South East Irrigated Area : Hydraulic processing

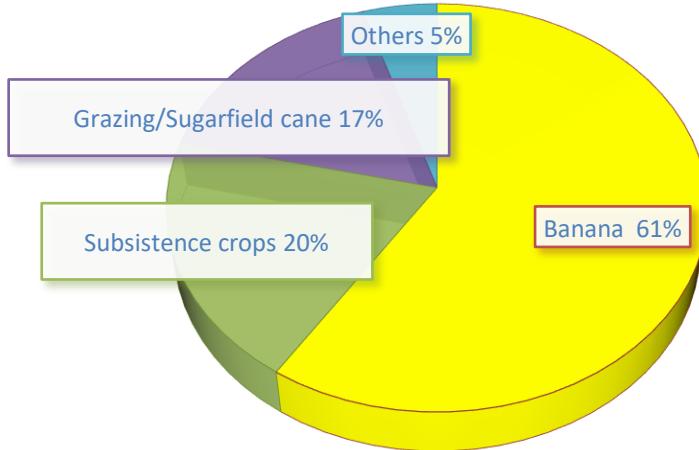


South East Irrigated Area : Overview

- ❖ 7722 acres irrigated
- ❖ 7 communities supplied
- ❖ 550 customers
- ❖ 150 km water networks
- ❖ 2 Pumping stations
- ❖ Manzo Dam

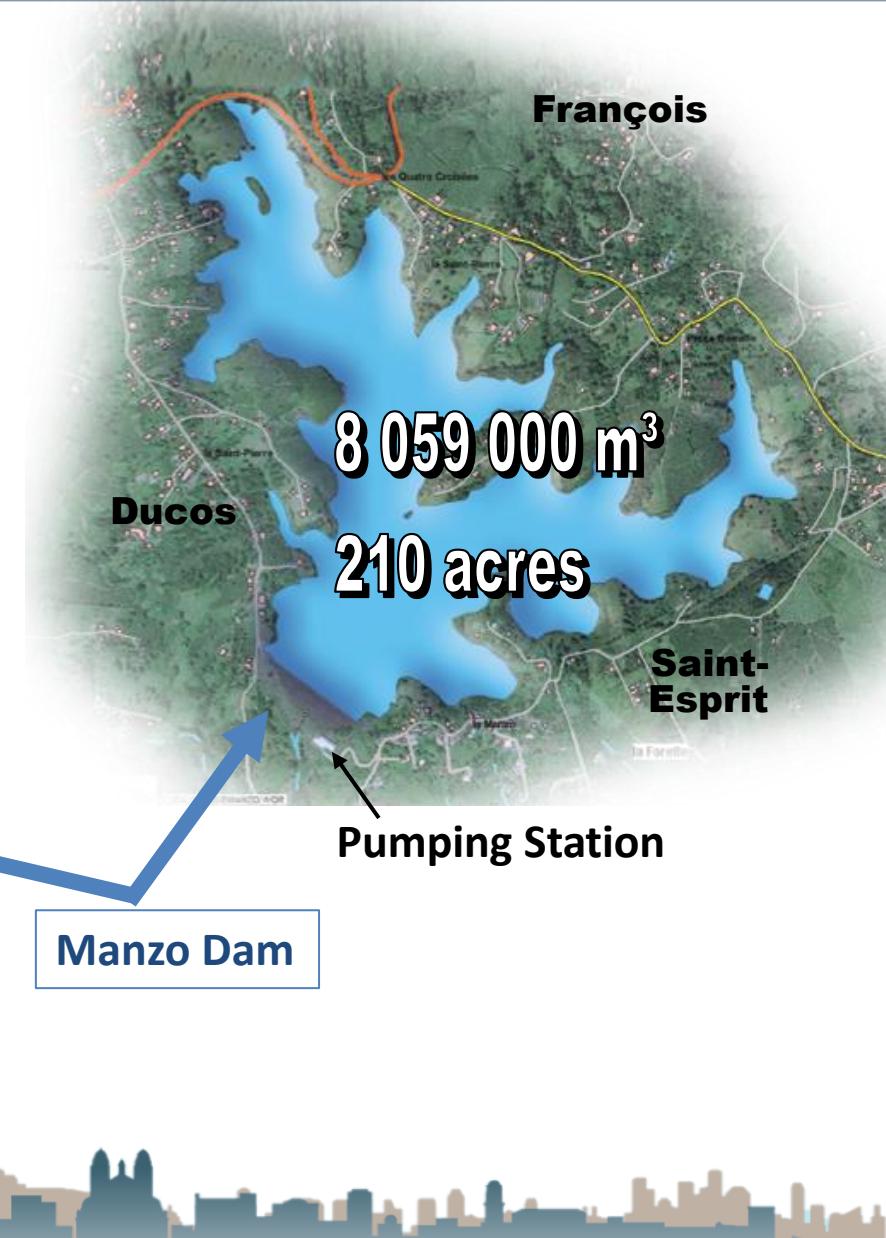
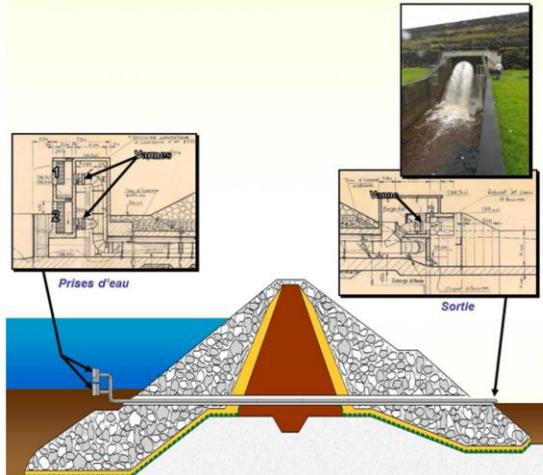


USES OF WATER



Manzo Dam : Overview

- ❖ Construction years : 1977-1979
- ❖ Owner : Martinique Territorial Authority
- ❖ Type : Rockfill embankment dam with central clay core
- ❖ Height : 27 meters up
- ❖ Length : 365 meters
- ❖ Dam volume : 310 000 m³



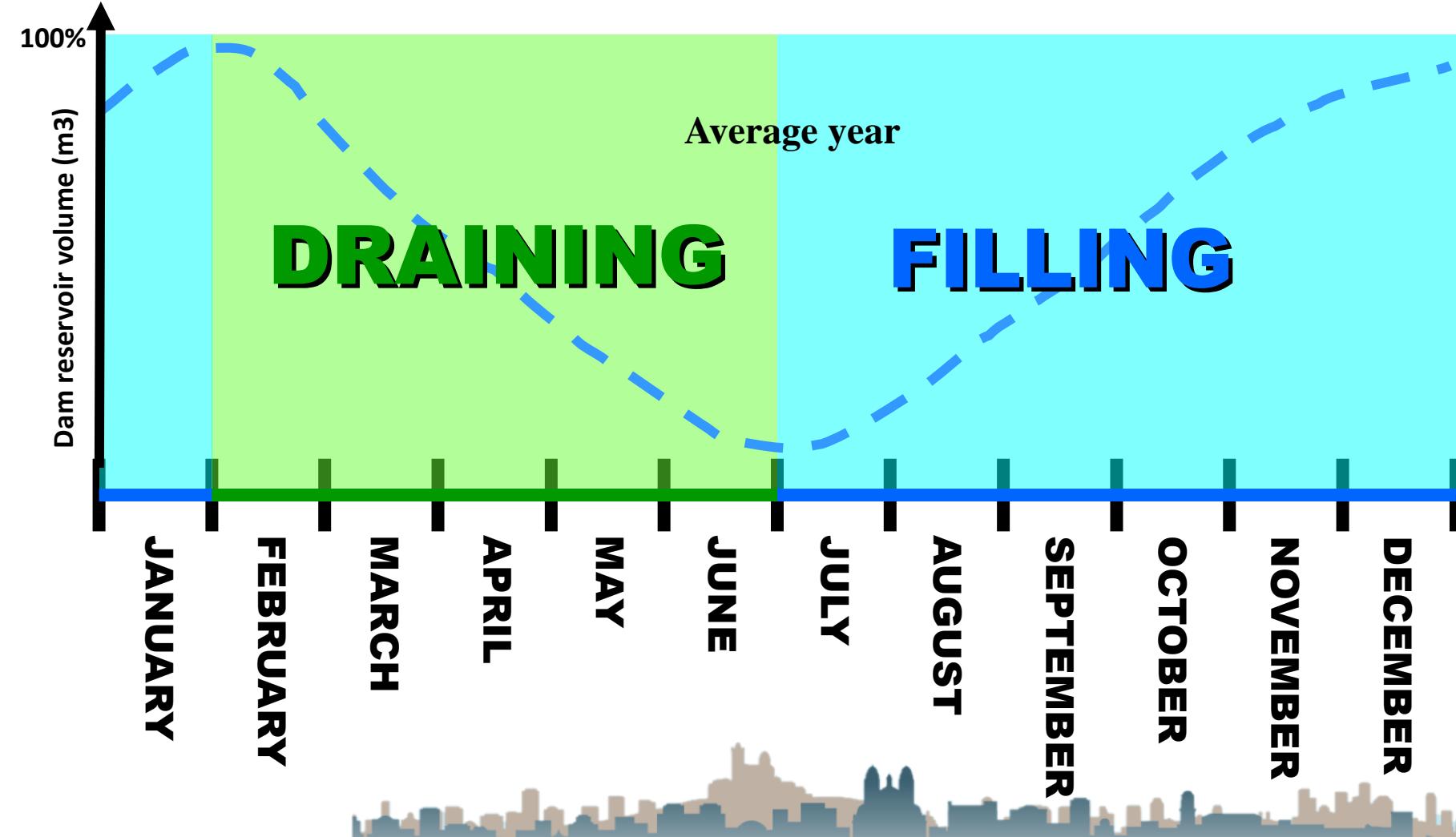
Manzo dam : Seasonal reservoir management

❖ Martinique tropical climate

❖ 2 distinct seasons :

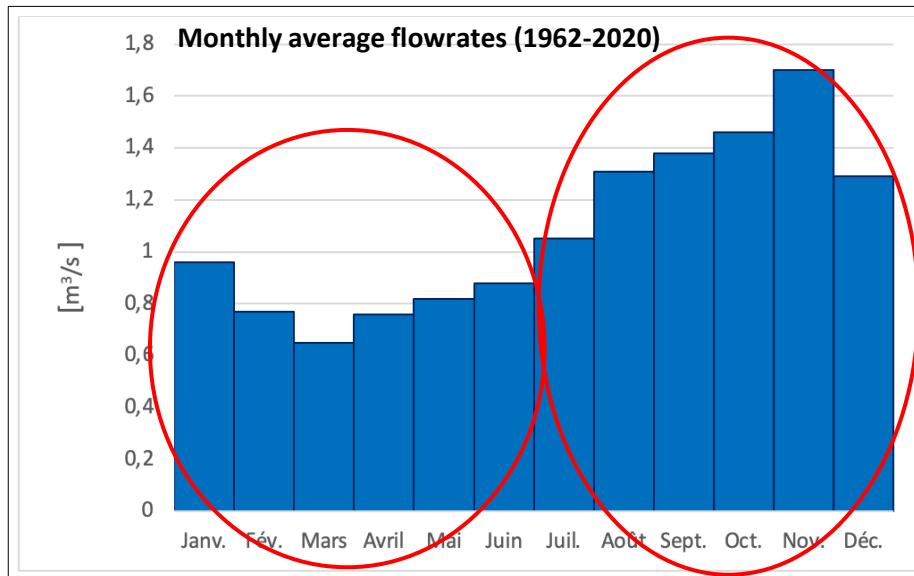
Dry season (february-june)

Wet season (july-january)



Lézarde river hydrological regime

- ❖ Seasonal stream flow : Alternation of **wet** and **dry** phases
- ❖ Flash floods



- ❖ Dry season river flow < **1,04 m³/s**
- Lézarde river resource availability is limited for irrigation supply.

	VCN 3 (m³/s)	VCN 10 (m³/s)
Biennale (2 years period)	0,23	0,26
	[0,19 - 0,26]*	[0,23 - 0,30]*
Quinquennale sèche (5 year period)	0,14	0,17
	[0,12 - 0,17]*	[0,14 - 0,20]*
Mean	0,26	0,29
Standard deviation	0,13	0,14

* Bornes de l'intervalle de confiance

Low flow

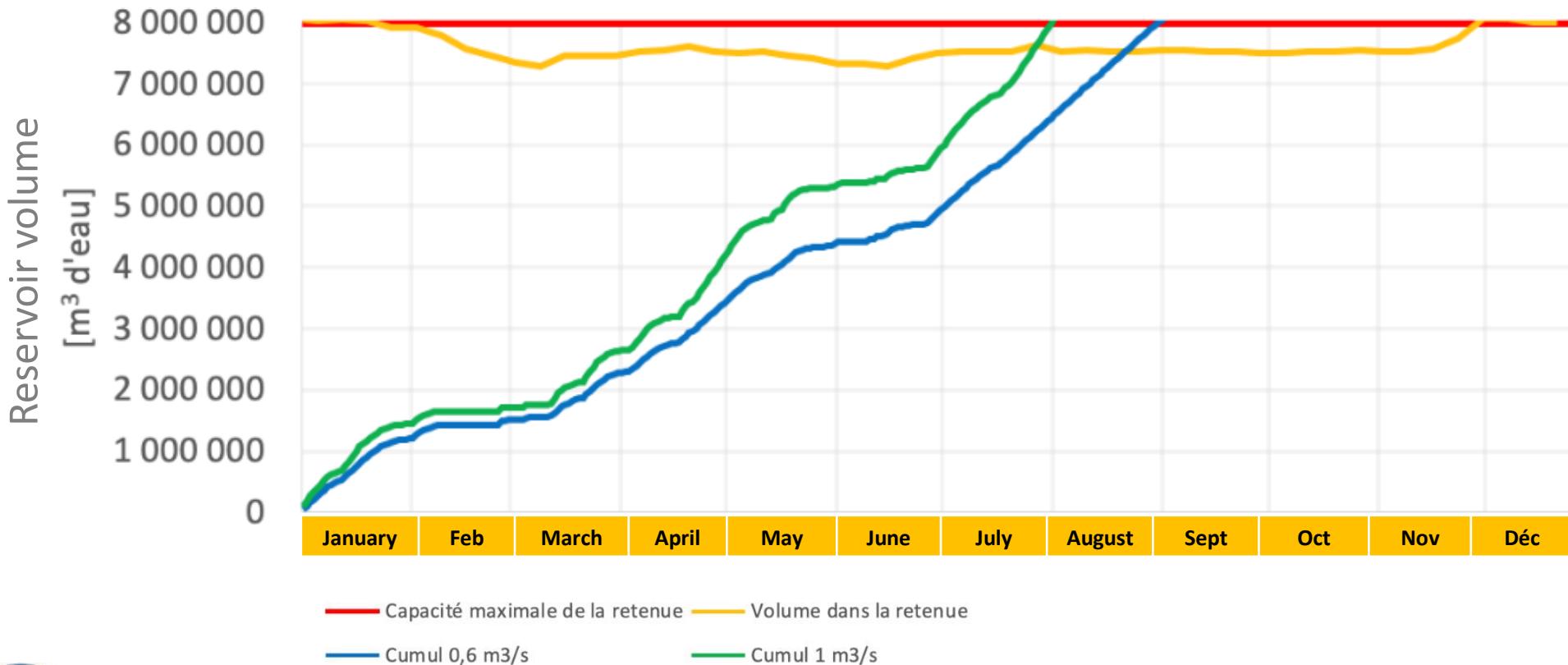
Mean discharge (m³/s)	Occurrence	Quinquennale sèche	Median	Quinquennale humide
1,09			1,1	1,2
[1,03 - 1,15]*	Flow rates (m³/s)	0,86 [0,79 - 0,93]*	[0,97 - 1,20]*	[1,20 - 1,30]*

* Bornes de l'intervalle de confiance

Mean annual streamflow

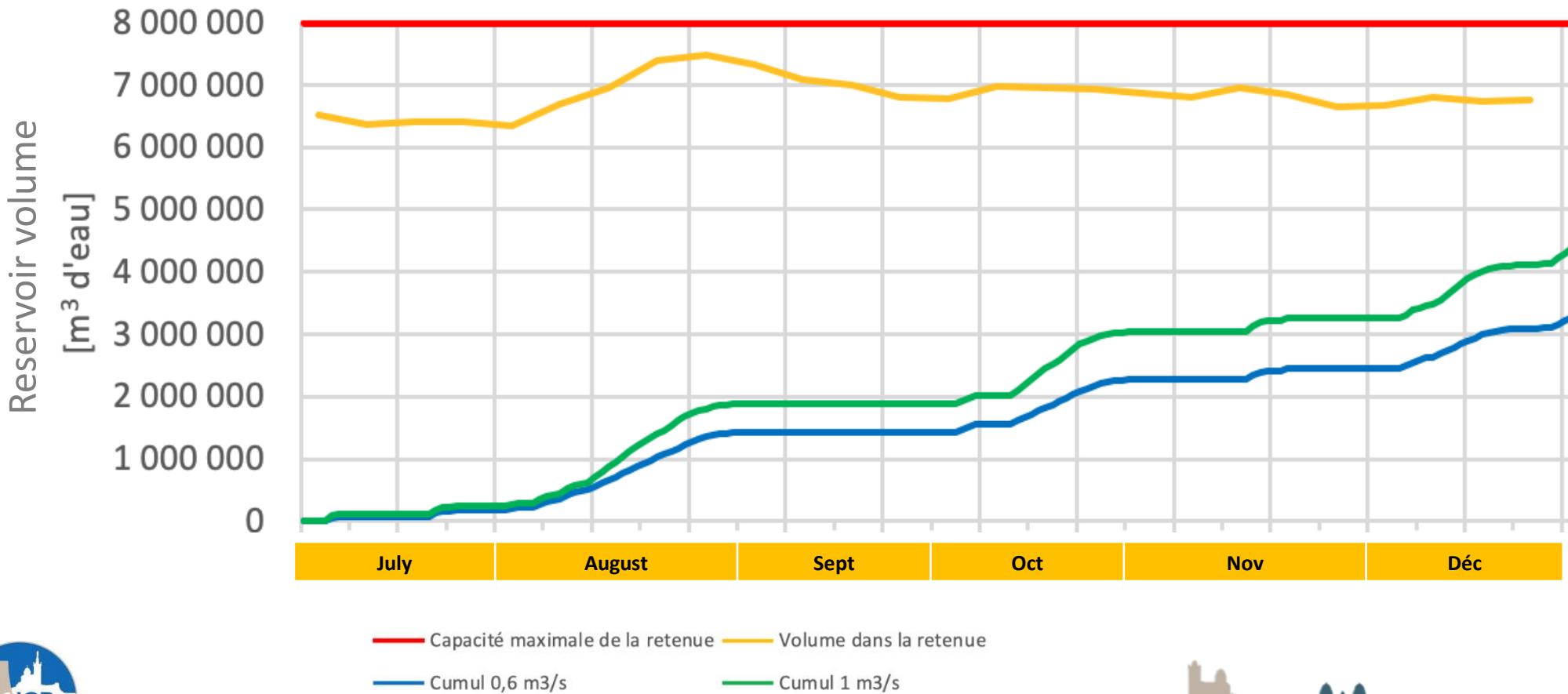
Manzo Dam reservoir storage : Limits and capacity

- ❖ Potential cumulative volumes from the Lézarde river during a global wet year (2012)
- ❖ 2 pumping flowrates simulations (600 l/s and 1000 l/s)

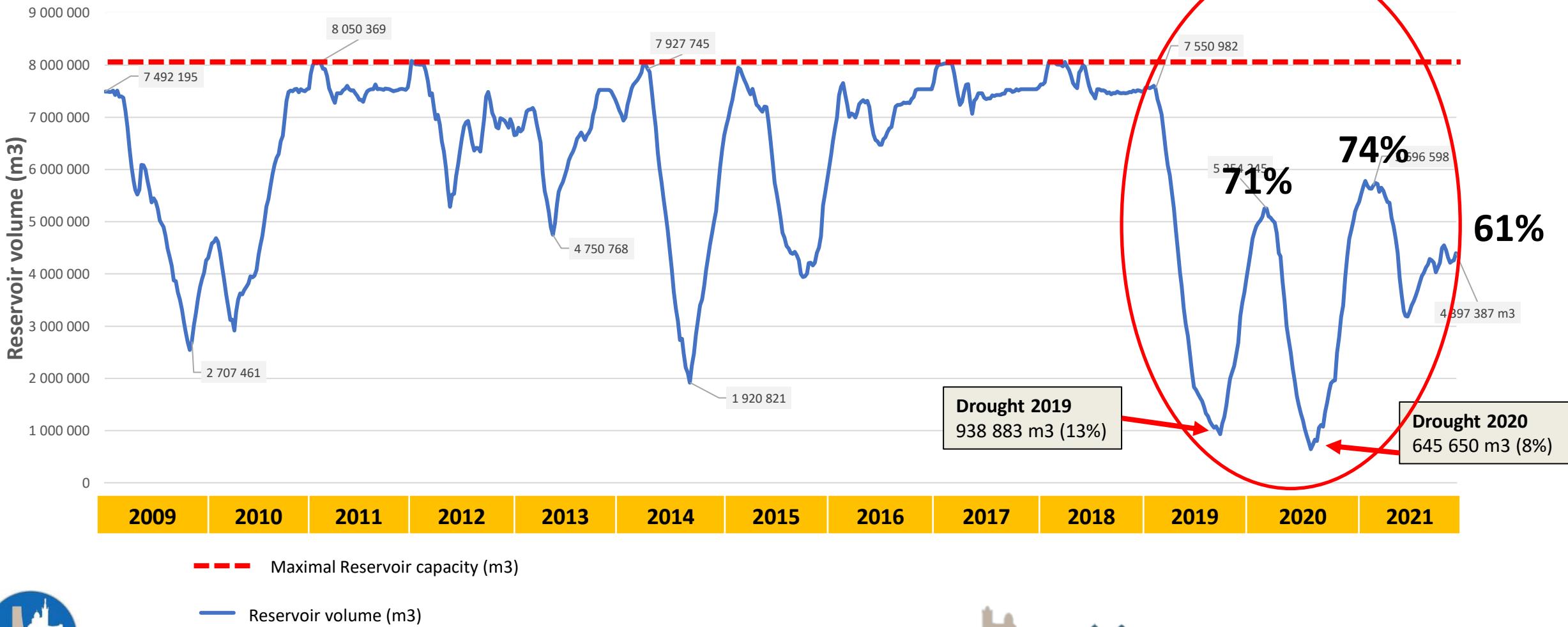


Manzo Dam reservoir storage : Limits and capacity

- ❖ Potential cumulative volumes from the Lézarde river during a deficit rainfall wet season (july-december 2011)
- ❖ 2 pumping flowrates simulations (600 l/s and 1000 l/s)



Manzo Dam : Evolution of reservoir volume 2009-2021



Manzo Dam : Evolution of the territorial issues

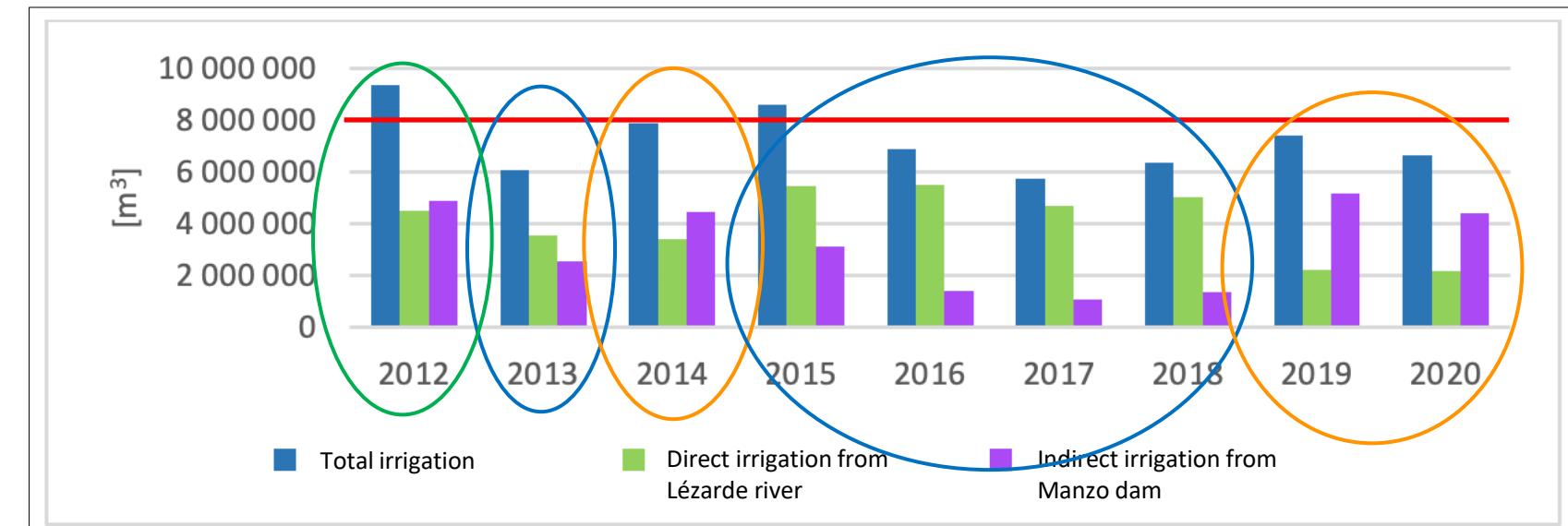
❖ Increasing water consumption

Close to the maximal capacity reservoir during dry season

❖ Manzo dam : Difficulties to fill up the reservoir

Limits → Lézarde river pumping station capacity
→ Water intake efficiency on Lézarde river

❖ More restrictions measures on the water supply network

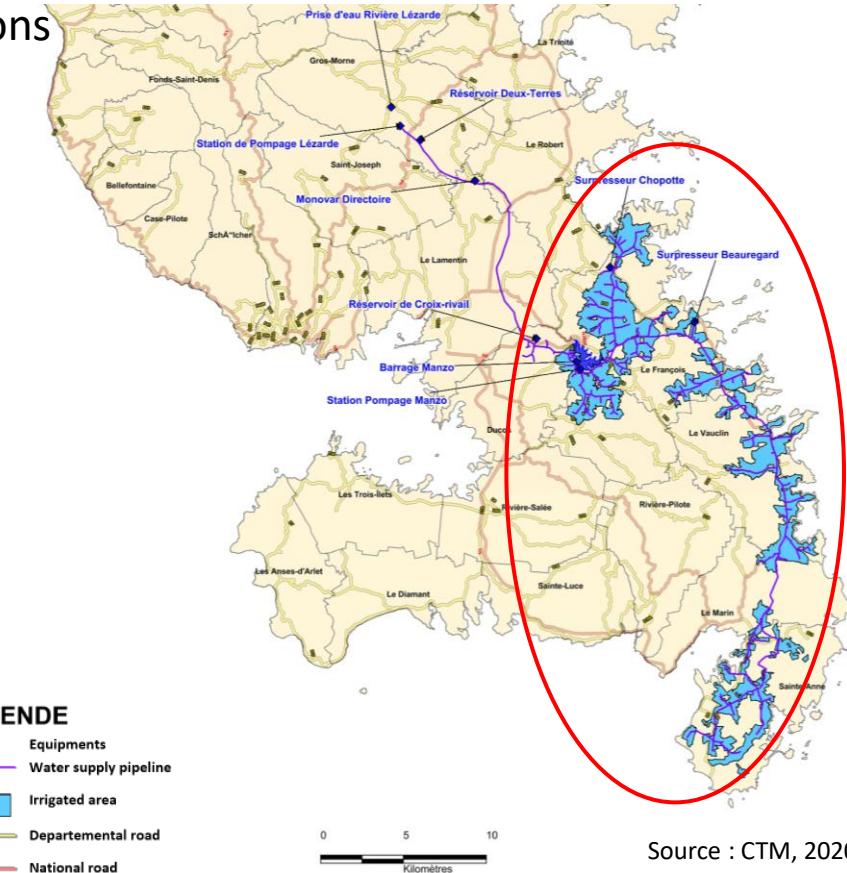


Water volumes supplied on the South East Irrigated Area from 2012 to 2020.

Effects of climate change on the South East region

Numerical modelling developed by BRGM, based on MeteoFrance climate projections
 Evaluate the effects of climate change in Martinique water resources by **2081-2100**

- ❖ **Warming temperatures** (+2°C to 3°C)
 >15% Evapotranspiration in the South East region (>5 mm/day)
- ❖ **Intensification** of the seasons :
 +38% precipitation in wet season
 From -25% to -50% precipitation during dry season leading to soil water deficit
- ❖ Average **flow rates depletion** in Lézarde river
- ❖ Alterations on water quality due to soil erosion and pollution load
- ❖ High quantitative **stress** on the available water resource



Conclusion

- ❖ Manzo dam : **Key role** in the South East region
- ❖ The **reservoir storage capacity is limited** when a dry season is followed by a « drier » wet season
- ❖ Solutions from hydraulic modelling of the water supply irrigation network :
 - Increasing Lézarde pumping station capacity
 - Maximizing Lézarde water intake efficiency during wet seasons
- ❖ Effects of **climate change** in Martinique will be worsening by 2081-2100
- ❖ Resilient and **adaptative strategies has to be set up** :
 - Assessment of Martinique irrigation potential (groundwater, treated wastewater reuse)
 - Implementation of an Irrigation Master plan and a territorial hydro-economic model
 - Creation of more hillside storage reservoirs
 - Changes in agricultural practices

