XVI
World Water Congress
International Water Resources Association (IWRA)
Cancun, Quintana Roo. Mexico. 29 May- 3 June, 2017

Adaptation mechanisms for extreme events in the Capibaribe River Basin

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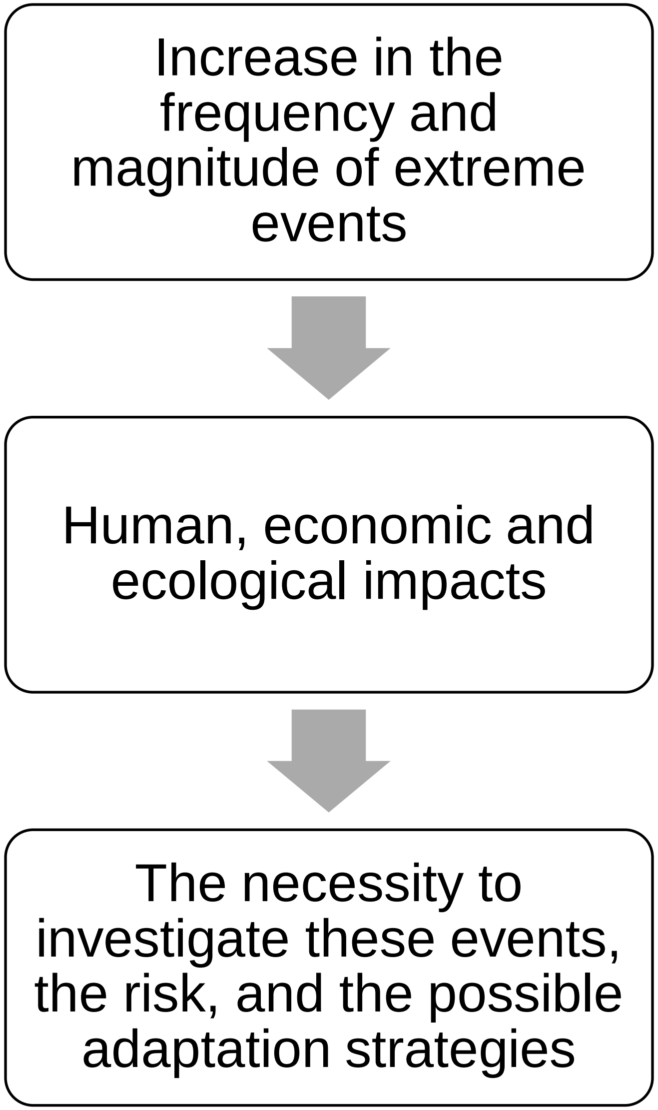
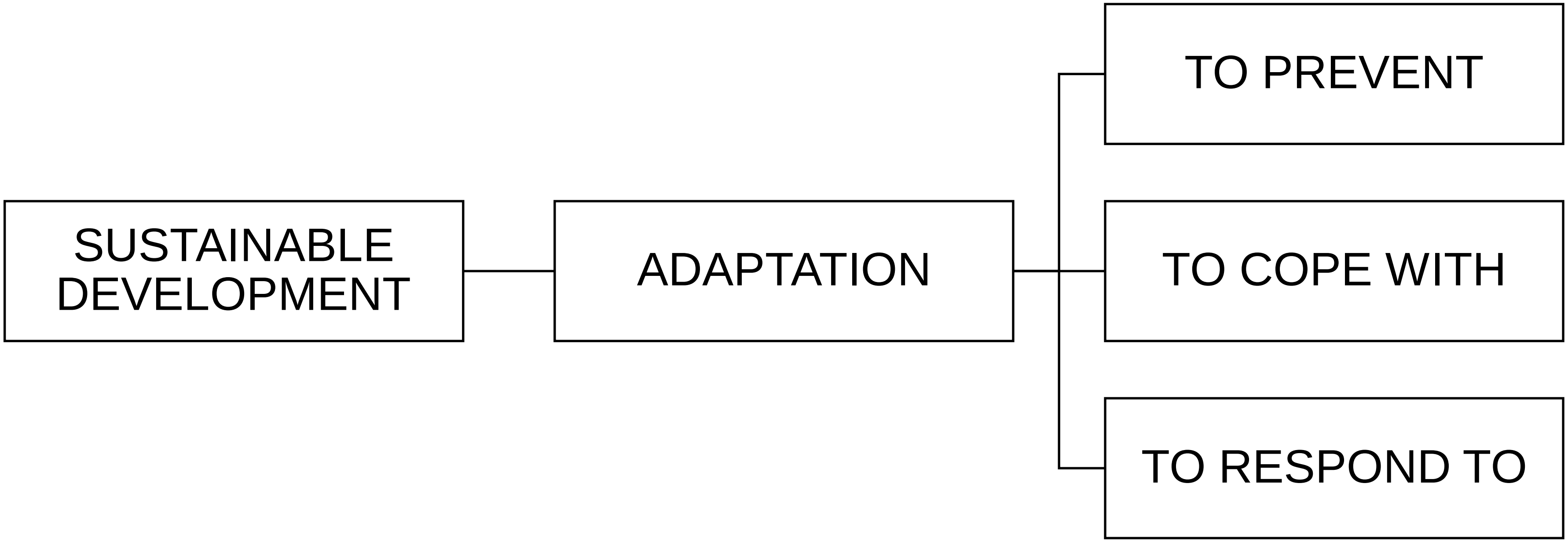
INTRODUCTION



INTRODUCTION



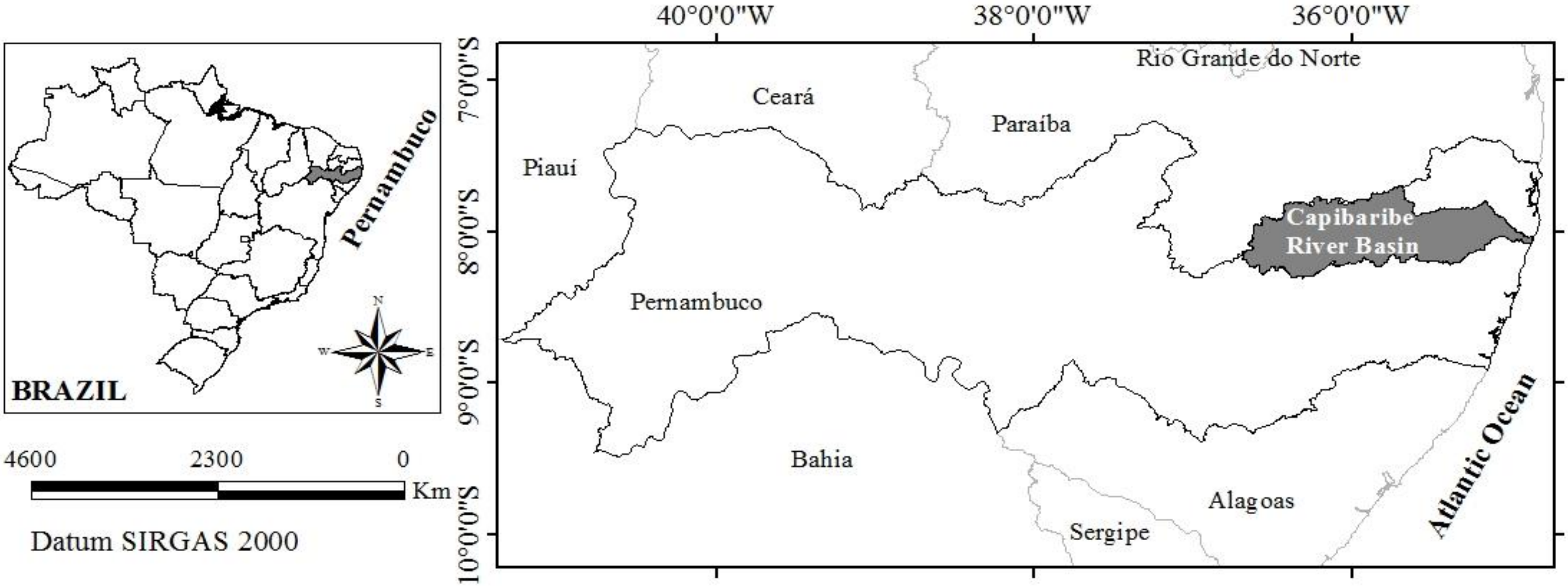
The evaluation of areas exposed to different events contributes to identify the level of relationship between technology, community, and extreme phenomena.

OBJECTIVES

- To characterize the climate spatial variability and the mechanisms used to deal with extreme events in the Capibaribe River Basin (CRB) – Brazil.

- To contribute with discussions around strategies of adaptation and their availability in the region.

STUDY AREA



- Drainage area: approx. 7454 km²
- 3 different geographic areas

- Historical and touristic importance
- Significant Socioeconomic influence
- Specific policies required

STUDY AREA

- Shallow soils
- Caatinga vegetation (thornscrub, cactus, and bunch grasses)
- Semiarid Climate
- 550 mm yr^{-1}
- Average air temperatures $20 – 22^{\circ}C$

- Deeper soils
- Atlantic Forest vegetation
- Humid/Sub-humid climate
- 2400 mm yr^{-1}
- Average air temperatures $25 – 26^{\circ}C$

HISTORY OF EVENTS

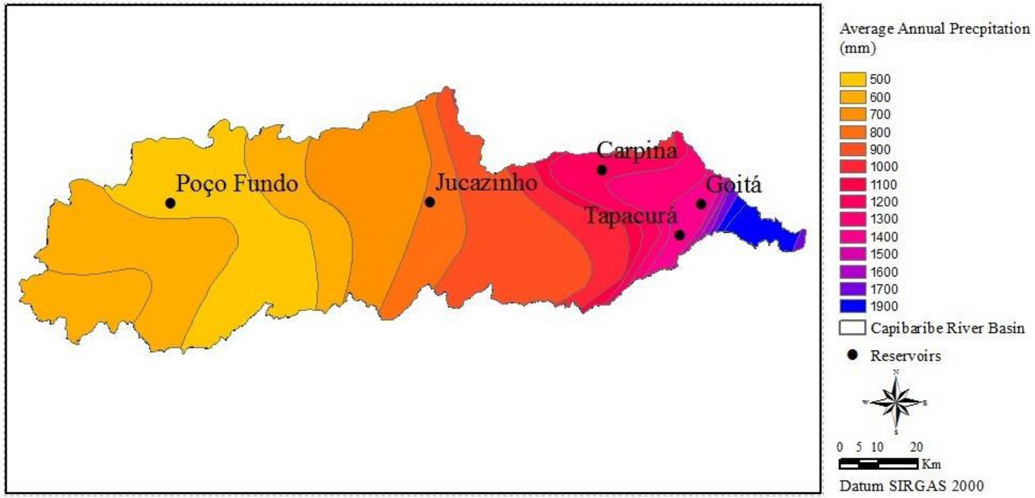
Century	Drought events (years with records)	Flood events (years with records)
17th	1603-1606; 1614-1615; 1652; 1692	1632; 1638
18th	1709-1711; 1720-1724; 1736-1737; 1744-1746; 1748; 1754; 1760; 1772; 1776-1777; 1782; 1784; 1790-1794	No records
19th	1804; 1808-1810; 1816-1817; 1824-1825; 1830-1833; 1844-1845; 1888-1889; 1891; 1898	1824; 1842; 1854; 1862; 1869; 1870; 1884; 1894; 1899
20th	1902-1903; 1907-1908; 1910; 1914-1915; 1919; 1932-1933; 1945; 1951; 1953; 1956; 1958; 1966; 1970; 1979-1981; 1983-1984; 1986-1987; 1991; 1993; 1997-1998;	1914; 1920; 1924; 1960; 1961; 1965; 1966; 1970; 1974; 1975; 1977; 1978; 2000
21st	2001; 2012-2016	2004; 2005; 2010; 2011


Jucazinho Reservoir in 2016.


Recife in 1975.

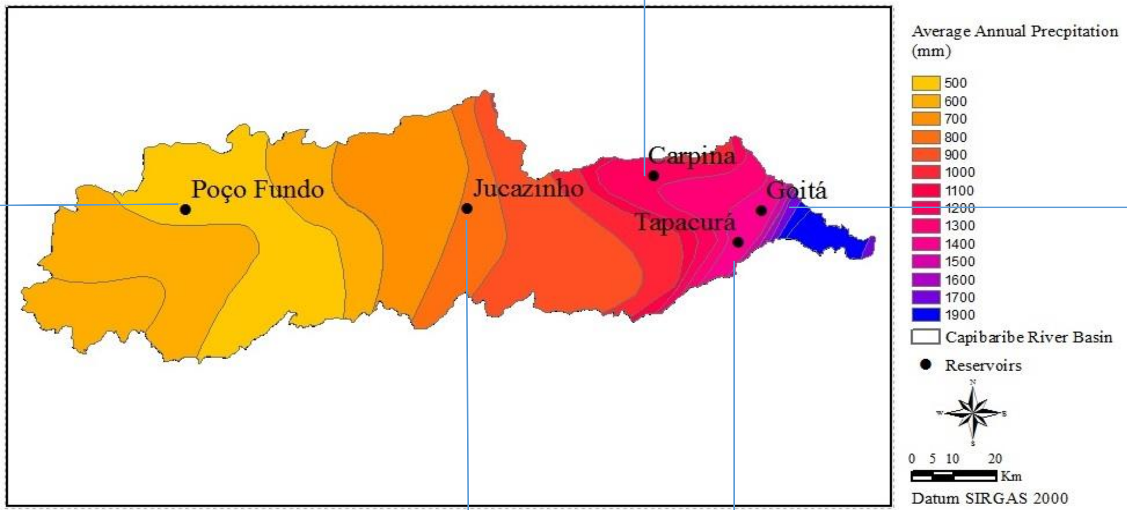
ADOPTED INFRASTRUCTURE AND NON-STRUCTURAL POLICIES

Reservoir	Drainage Area (km²)	Total volume ($x10^6$ m³)	Useful volume ($x10^6$ m³)	Average inflow (m³/s)	Inauguration	Purpose
Tapacurá	360	98.7	98.7	2.25	1973	**Flood control** and supply
Goitá	450	52.0	15.6	2.00	1976	**Flood control** and supply
Carpina	5999	270.0	81.0	6.92	1978	**Flood control**, supply and fishery
Poço Fundo	854	27.75	27.75	1.47	1986	Supply and irrigation
Jucazinho	4171	327.0	227.0	6.34	1999	Supply and pisciculture



ADOPTED INFRASTRUCTURE AND NON-STRUCTURAL POLICIES

- **Construction of dams**



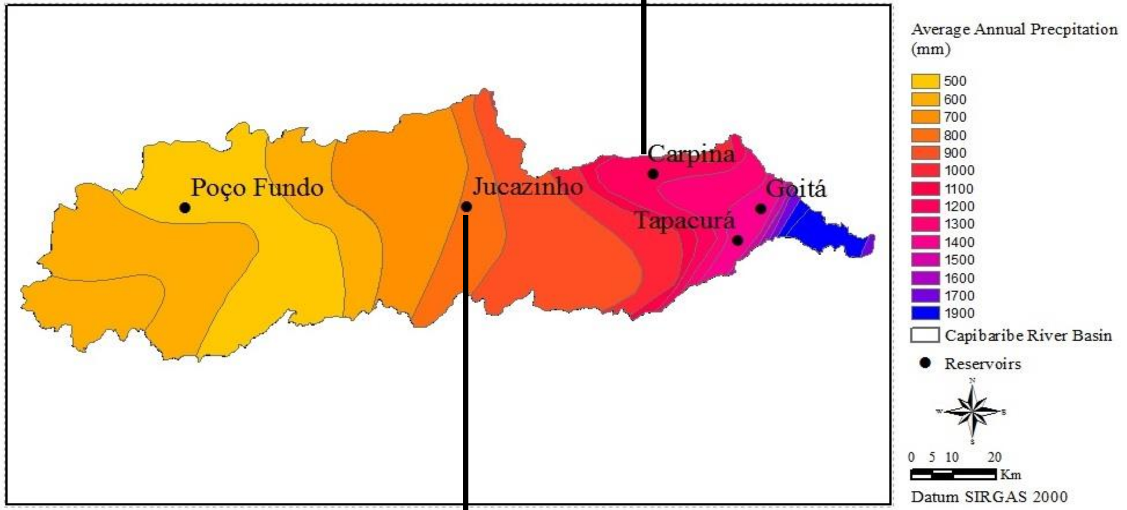
ADOPTED INFRASTRUCTURE AND NON-STRUCTURAL POLICIES

- **Management of dams**

Total volume: 270 million m³

Volume (wet season): 50 million m³

Opening dam floodgates: 100 million m³



Total volume: 327 million m³

Volume (wet season): 40 million m³

ADOPTED INFRASTRUCTURE AND NON-STRUCTURAL POLICIES

Governmental Programs developed to deal with natural and social hazards that enhance population resilience:

- **“Bolsa Família”**
  - Income distribution to poor and extremely poor families
  - More than 13.9 million recipient families so far in Brazil
- **“Garantia-Safra”**
  - Support to rural households in municipalities that are susceptible to suffer loss of crops due to shortage or excess of water
  - From 2010 to 2014 this program registered more than 3.6 million farmers
- **“Chapéu de Palha”**
  - A Program of the Pernambuco State Government
  - Support to unemployed rural workers due to offseason dynamics or natural disasters
  - Attending 54 municipalities in the state

ADOPTED INFRASTRUCTURE AND NON-STRUCTURAL POLICIES

- **Water trucks**

  Advantages: Fast response

  Disadvantages: Temporary solution

- **Small reservoirs**

  Advantages: Irrigation, human supply and fish-farming

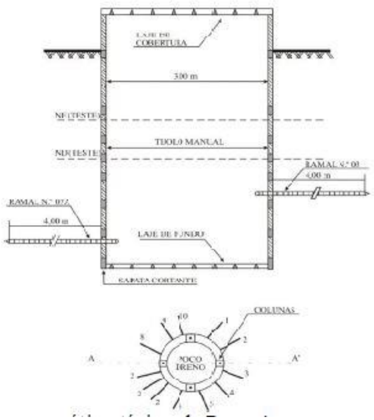
  Disadvantages: High evaporation rates, indiscriminate dissemination

- **Rural cisterns**

  Capacity: 7-15 m^3

  Availability: 50 L of water per day during 140 – 300 days

ADOPTED INFRASTRUCTURE AND NON-STRUCTURAL POLICIES



- **Groundwater**

  Advantages: Human and animal water supply, protection from high evaporation rates

  Disadvantages: Deficiencies in the management and the lack of public incentives

  Availability: 50 L of water per day during 140 – 300 days

- **Underground dams**

  Advantages: Promotion of infiltration and storage. of rainwater in alluvial deposits, protection from evaporation and salinization, low cost.

  Availability: Estimated 2,240 units throughout the northeastern semiarid.

EXAMPLES IN OTHER COUNTRIES OF HOW TO COPE WITH HYDROLOGICAL EXTREMES

- Use of different cropping techniques and types of crops for each season (Zimbabwe)
- Construction of dams (China)

- Rainwater Harvesting and Managed Aquifer Recharge (Thailand)

- Early warning systems
- Monitoring techniques
- Development of conservancy projects
- Forecast modeling

DISCUSSION

- The level of climate variability in the study area is coherent with other regions worldwide, especially places that face both flood and drought events.

- Vulnerability is not only related to natural aspects, but it is also part of political, economic and social processes.

- The CRB is not an exception; the solutions observed in the region resemble others displayed by the literature, especially in agricultural based communities.

- Aside from all the alternative adaptation strategies, reservoirs play an important role, being the largest most popular structures used to face both drought and flood events.

FINAL REMARKS

- The reservoirs are the main option chosen to face drought and flood events in CRB.

- For small communities in the rural zone alternative techniques are more suitable, such as cisterns, groundwater, and underground dams.

- The assistance programs originally created for income transfer for poor families can currently also be considered as an adaptation measure in Northeast semiarid.

- The idea is that technologies applied to cope with hardening climate conditions can corroborate to an effective risk management and sustainable development, in short and long terms.

ACKNOWLEDGEMENTS

This paper is a contribution of the Brazilian Network on Global Climate Change Research funded by Brazilian National Council for Scientific and Technological Development (CNPq) and FINEP.

The authors also acknowledge the Inter-American Institute for Global Change Research, which is supported by the US National Science Foundation.

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Thank you

Gracias

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