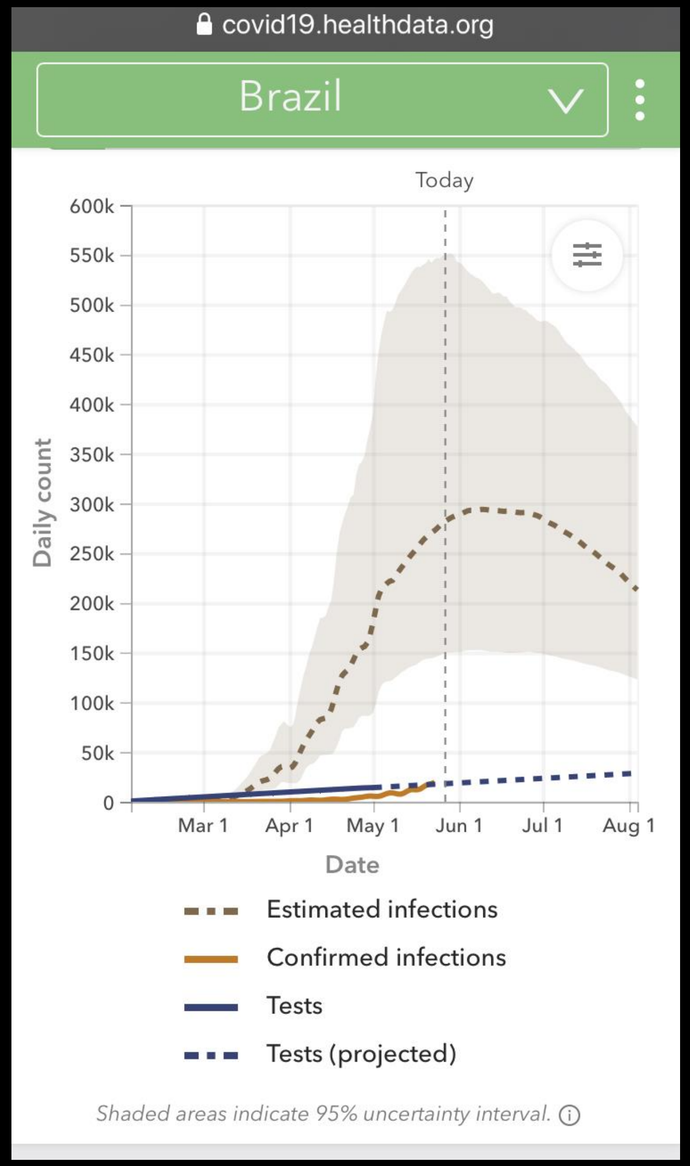
UN-WWQA – COVID-19 WEBINAR

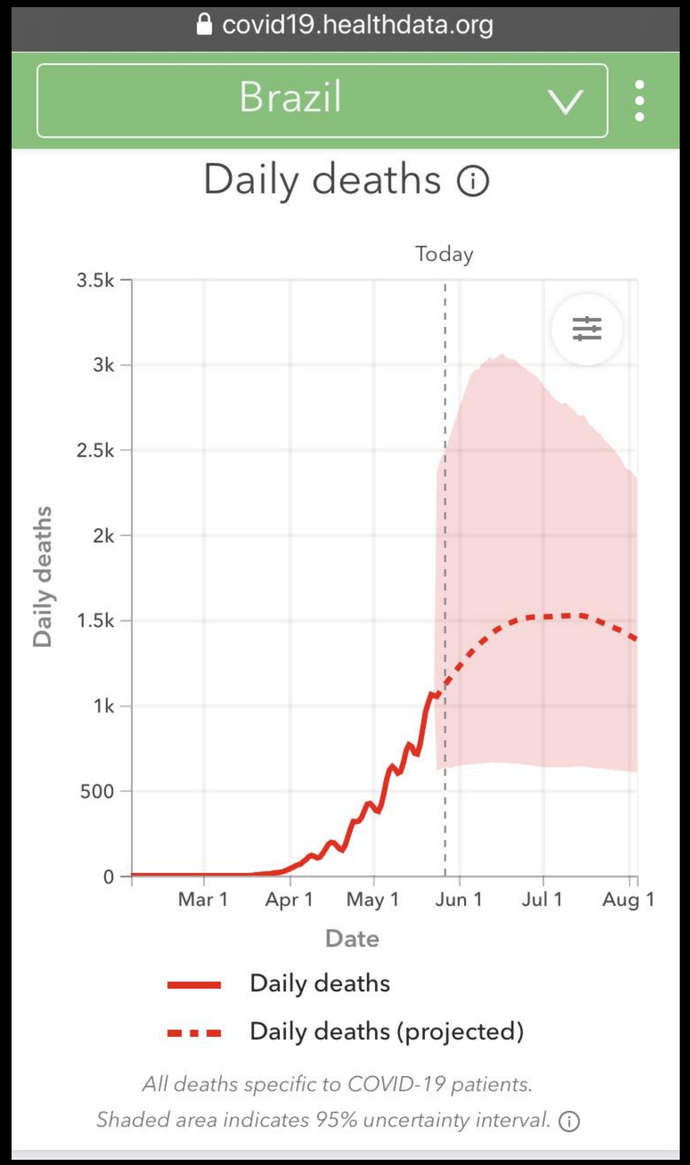
THE YEAR THE 21ST CENTURY BEGAN: COVID-19 AND WATER QUALITY

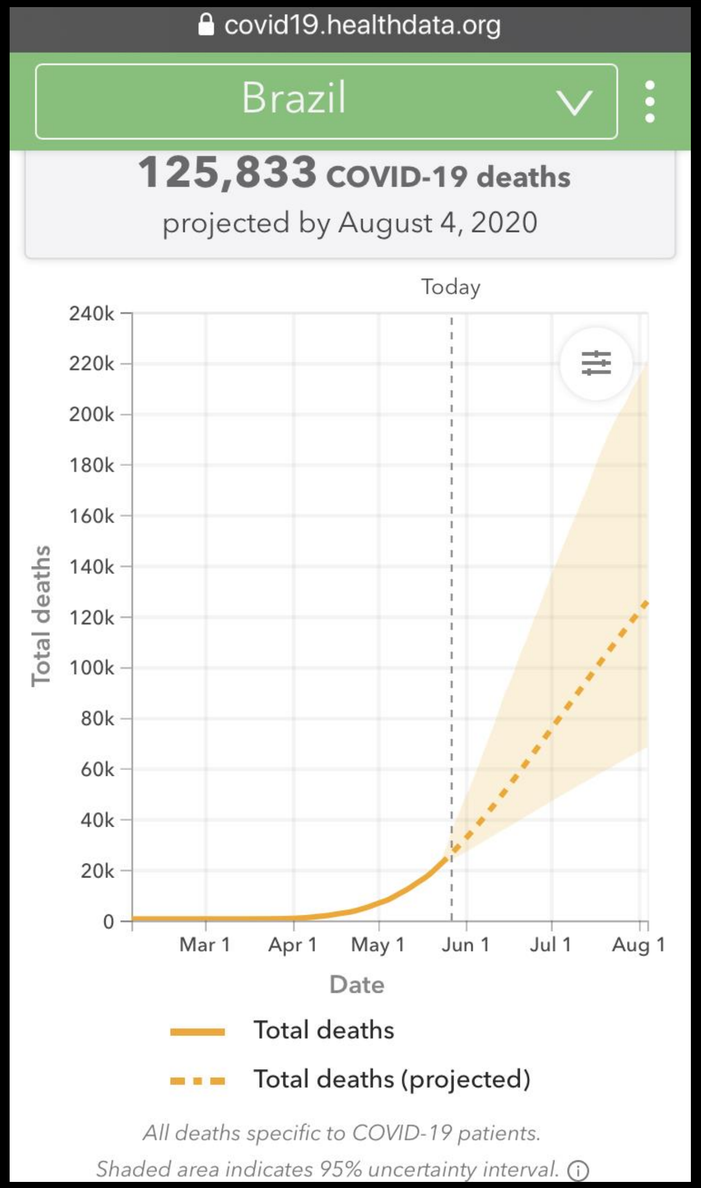
May 27th, 2020

Eduardo Mario Mendiondo
The WADI Lab - Water-Adaptive Design & Innovation
Dept Hydraulics & Sanitation Engineering
Escola de Engenharia de Sao Carlos
University of Sao Paulo - Brazil
emm@sc.usp.br
Tel: +55 16 997221438

COVID-19's time series with forecast in Brazil (updated on 27 May, 2020)

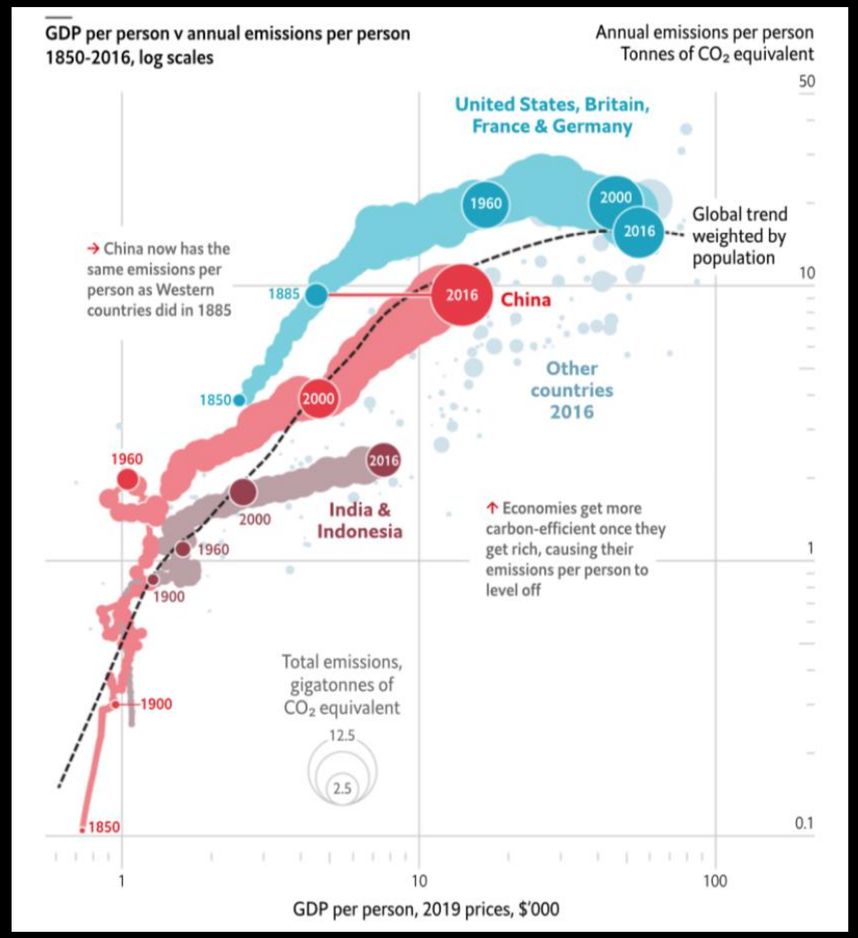


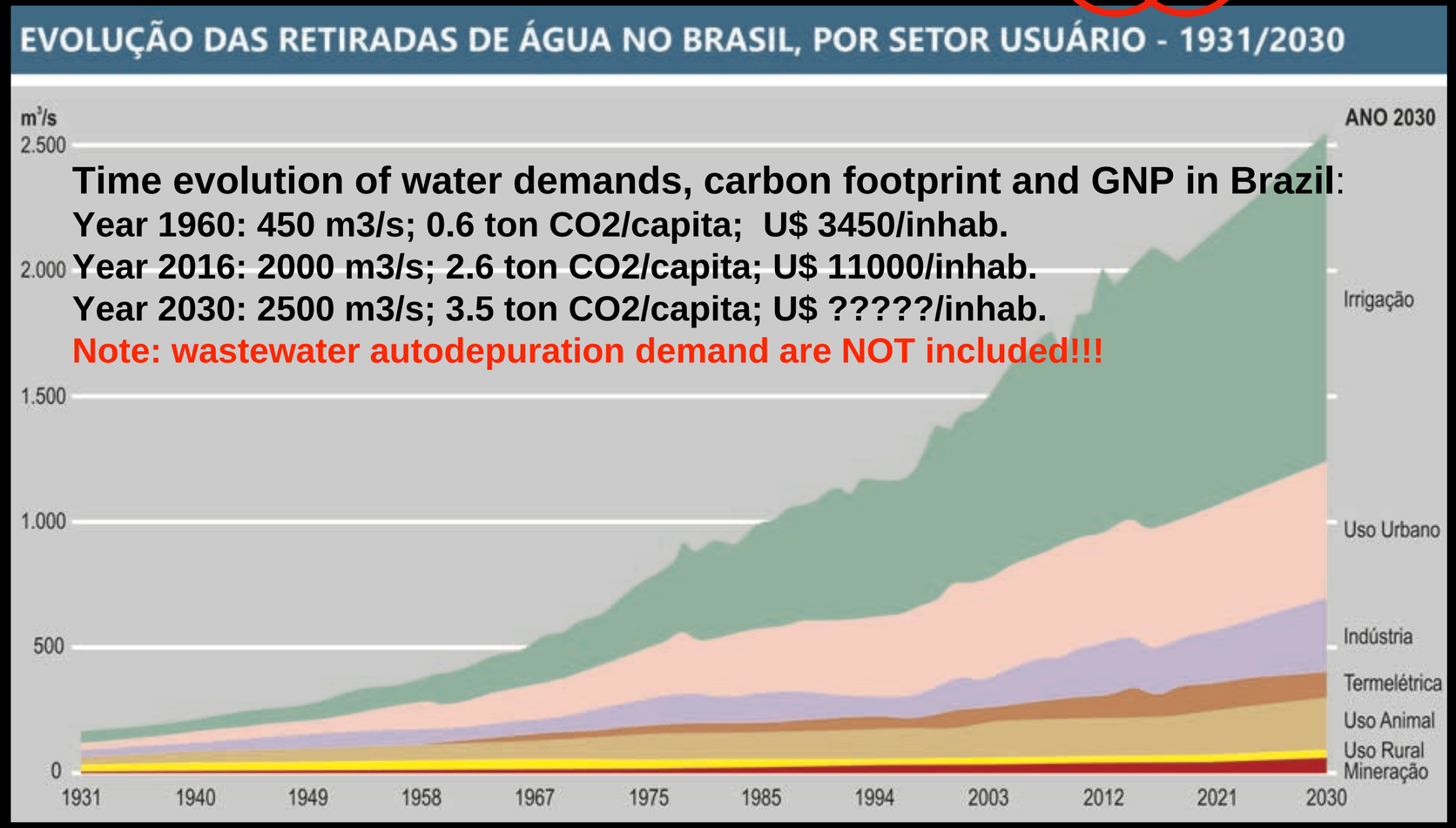




1960-2030's timeframe of water withdrawals, carbon footprint and GNP in Brazil

Total untreated wastewater is ca. 15-30 times higher than total water withdrawal





Time evolution of water demands, carbon footprint and GNP in Brazil:

Year 1960: 450 m3/s; 0.6 ton CO2/capita; U$ 3450/inhab.

Year 2016: 2000 m3/s; 2.6 ton CO2/capita; U$ 11000/inhab.

Year 2030: 2500 m3/s; 3.5 ton CO2/capita; U$?????/inhab.

Note: wastewater autodepuration demand are NOT included!!!

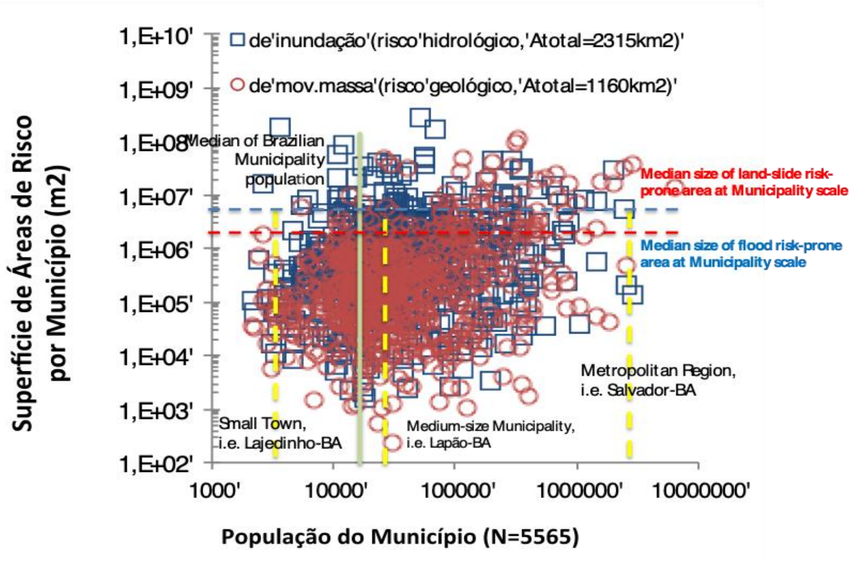
- NEXT STEPS: a new generation WTA insurance with PES would support of EbA for WEF+B under climate change if decision-makers do acknowledge innovative governance with more policies of Public-Private Partnerships (PPPs) planned for population empowerment at > 40,000 Brazilian Risk Prone Areas

Brazil 2018: 40.000 vulnerability areas with 60million people needing adaptation strategies for water security

The gap for insurance: these initiatives are still under progress, especially to cope with floods, landslides, droughts, progressive biodiversity losses, energy burnouts, fires and desertification.

Problems: BRAZILIAN HOT SPOTS

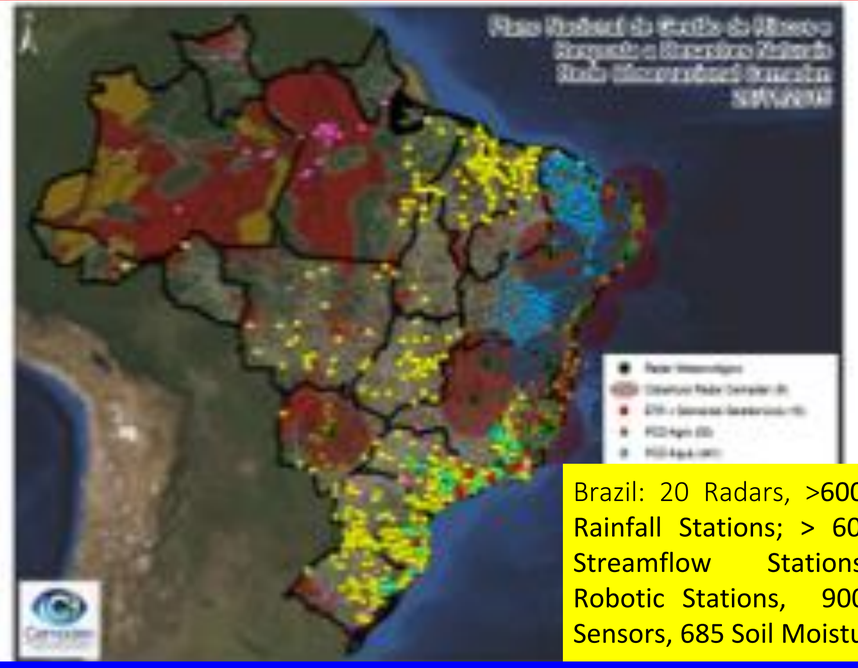
- strong social/environ. vulnerability
- > 60% of Brazilian GNP threatened by water disaster risks
- 40,000 risk areas mapped,
- approx. 6 risk areas / municipality
- 1 education station /10 rainfall st.
- 95% of risk-prone areas with time of concentration < 2 hours,
- complex patterns of land-use and socioeconomic vulnerability,



Opportunities for WTA Insurance:

Low-cost technologies for disaster risk reduction in vulnerability areas:

- social media (SM)
- citizen observatories (CO)
- water security framework
- in line with recent Federal Acts of: Water Resources (1997), Urban Waters (2007), Climate Change Policy (2009) and Civil Protection (2012)



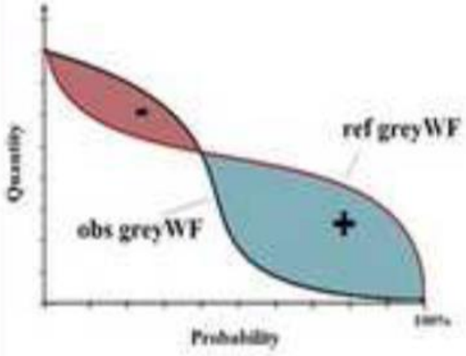
Brazil: 20 Radars, >6000 Online Rainfall Stations; > 600 Online Streamflow Stations; 10* Robotic Stations, 900 Motion Sensors, 685 Soil Moisture Sts

SocioHydrological Observatories for Water Security: Observations through Under-Represented Sensors for the Prediction in Ungauged Basins

Diversity of Brazilian basins under different climates, drainage areas, land uses and river regimes (water quantity and quality).

Secondary data & environmental standards

- Pollutant loads (WaterES demand)
  - Observed grey Water Footprint (*greyWF*)
  - Reference grey Water Footprint (*greyWFref*)
  - $[greyWF - greyWFref]_{Prob}$ = Watershed Degradation (*WD*)
- Water yield (WaterES supply)
  - Long-term flow (*Qlp*)
- *RVC* = reference value for conservation (US$/ha.year)
- $VWaterES = VRC \cdot F(WD/Qlp)$



WD <=0, assumes minimal value (*VWaterES* = *VRC*)
WD > 0, leads to higher values (*VWaterES* > *VRC*)

$

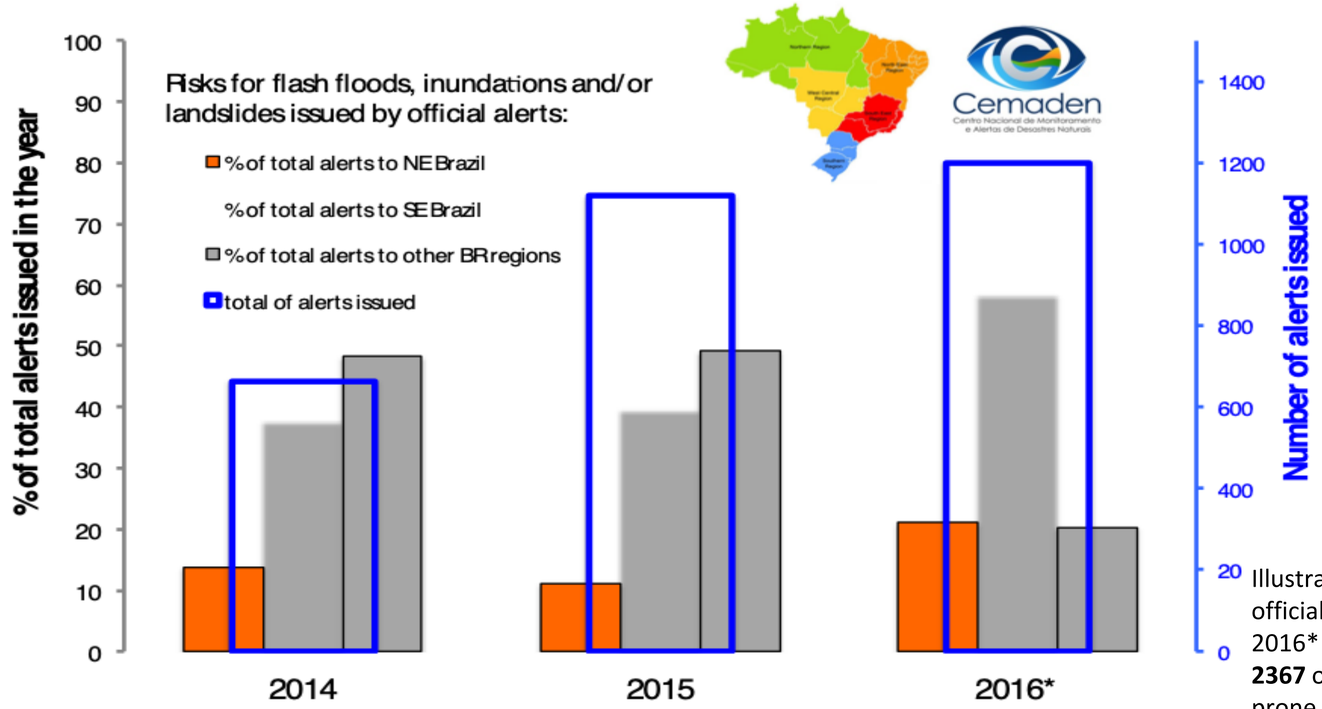
Monetary incentive for water related ecosystem services (*WaterES*)

Funder
Provides $ support

Taffarello et al (2020), Ecosystem Service Valuation Method in Partially-Monitored Subtropical Watersheds, Science of the T

Train your brain... São Carlos, SP (Nov. 23th 2015; Drainage area= 77km2; Flood duration movie: 2h)

The Brazilian Socio-Hydrology Gap: WWQ warnings are urgently needed at national and states' scales under institutional protocols* (ANA/CEMADEN/CENAD/CPRM+States, Brazilian Law of Civil Protection #12.208/2012). More than 90% of critical WWQ prone areas (with people) has runoff time of concentration below 2 hours!!!. Pictures below show flood resilience in Brazilian States. Source: WADILab



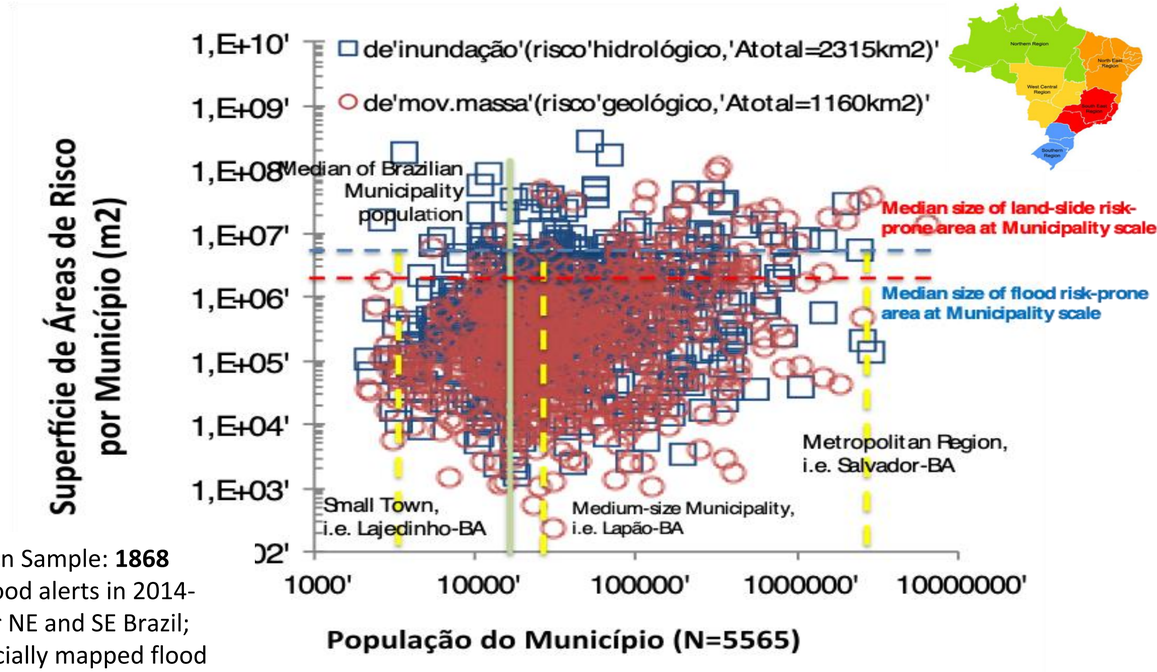
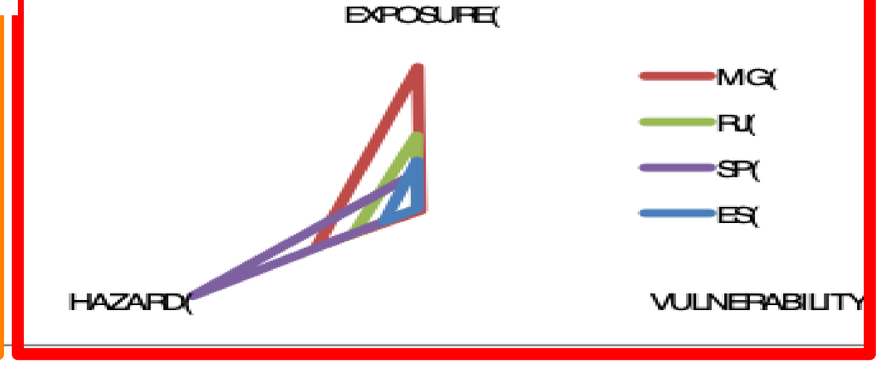


Illustration Sample: **1868** official flood alerts in 2014-2016* for NE and SE Brazil; **2367** officially mapped flood prone areas in NE + SE Brazil; **50.1** million people living in NE+SE municipalities; **1275** own rainfall stations

States of NE Brazil

States of SE Brazil



- WWQA can profit from pioneering science and policy actions considering climate services, willingness-to-pay/accept mechanisms and financial insurance for the WEF+B nexus (Wastewater, Ecosystem, Food + Biodiversity) in subtropical catchments.

Climate Services 8 (2017) 1–16

Contents lists available at ScienceDirect

Climate Services

journal homepage: www.elsevier.com/locate/cliser

Hydrological services in the Atlantic Forest, Brazil: An ecosystem-based adaptation using ecohydrological monitoring

Denise Taffarello[a,*], Maria do Carmo Calijuri[a], Ricardo A. Gorne Viani[b], José A. Marengo[c], Eduardo Mario Mendiondo[a]

Ecological Economics 140 (2017) 66–78

Contents lists available at ScienceDirect

Ecological Economics

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Economic indicators of hydrologic drought insurance under water demand and climate change scenarios in a Brazilian context

Guilherme Samprogna Mohor *, Eduardo Mario Mendiondo

Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2017-615
Manuscript under review for journal Hydrol. Earth Syst. Sci.
Discussion started: 20 November 2017

Hydrology and Earth System Sciences Discussions

1 **Economic impacts of drought risks for water utilities through**
2 **Severity-Duration-Frequency framework under climate change**
3 **scenarios**

4 Diego A. Guzmám[1-2], Guilherme S. Mohor[1], Denise Taffarello[1] and Eduardo M. Mendiondo[1]

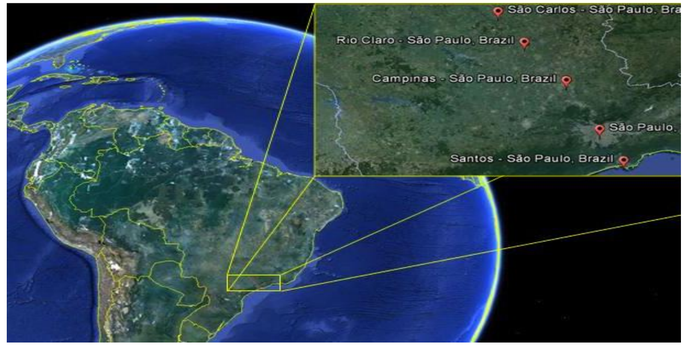
Hydrol. Earth Syst. Sci., 22, 4699–4723, 2018
https://doi.org/10.5194/hess-22-4699-2018

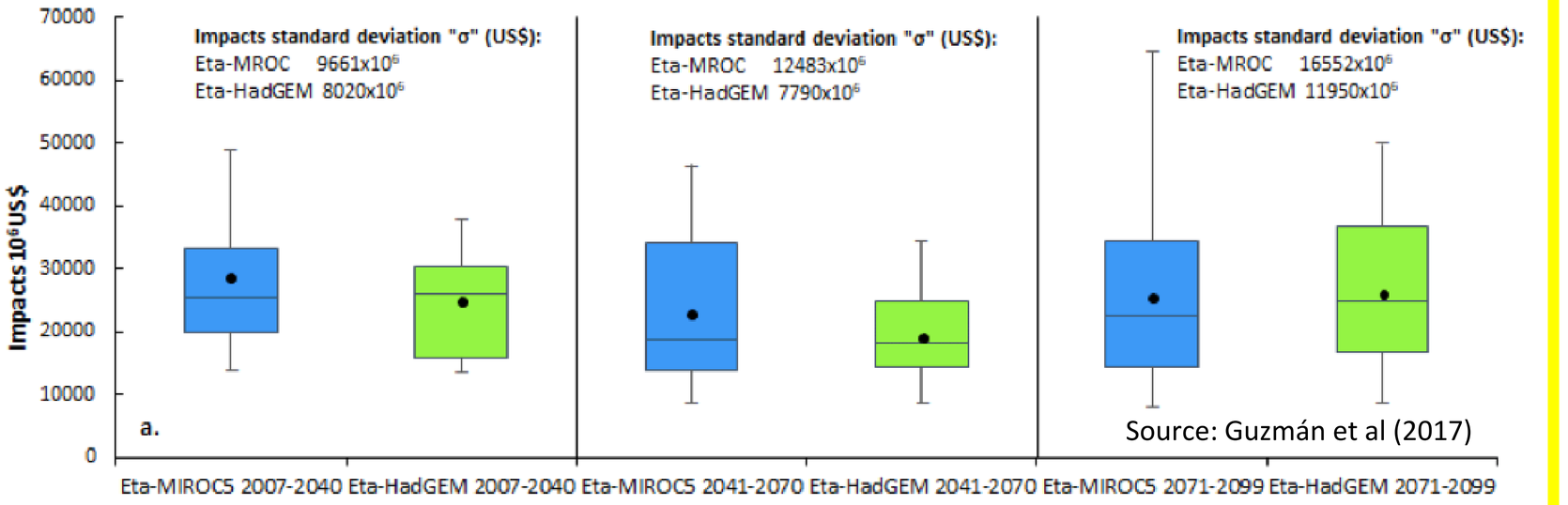
Hydrology and Earth System Sciences

Modeling freshwater quality scenarios with ecosystem-based adaptation in the headwaters of the Cantareira system, Brazil

Denise Taffarello[1], Raghavan Srinivasan[2], Guilherme Samprogna Mohor[1,3], João Luis Bittencourt Guimarães[4], Maria do Carmo Calijuri[1], and Eduardo Mario Mendiondo[1]

- With WTA concept, we addressed insurance premiums to cover users' losses as mitigation mechanisms on climate change** and aging infrastructure, extending works to strategic, but vulnerable river basins strongly dependant on water footprints for hydropower, food production and water supply in Southeast Brazil





Source: Guzmán et al (2017)

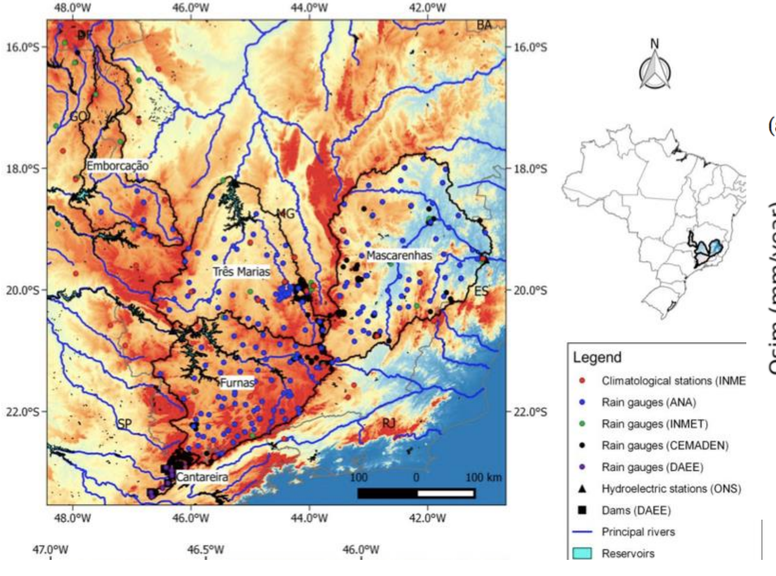
Hydrological Processes

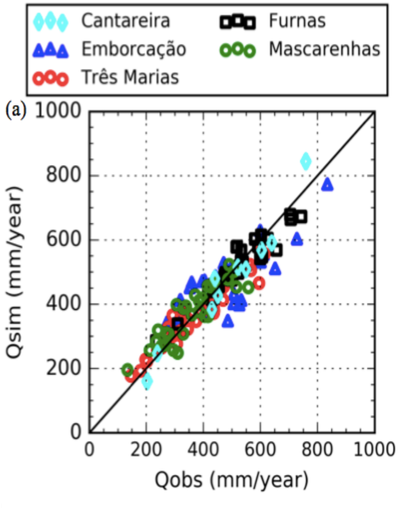
RESEARCH ARTICLE

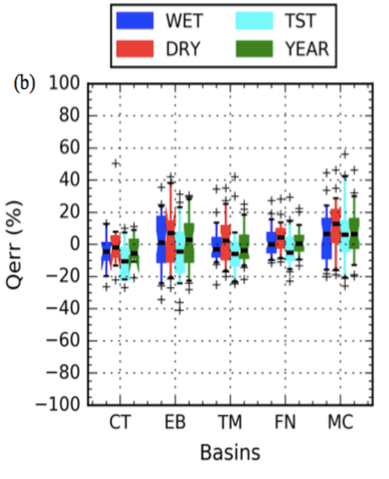
Season-based rainfall–runoff modelling using the probability-distributed model (PDM) for large basins in southeastern Brazil

Rong Zhang, Luz Adriana Cuartas, Luiz Valerio de Castro Carvalho, Karinne Reis Deusdará Leal, Eduardo Mário Mendiondo, Narumi Abe, Stephen Birkinshaw, Guilherme Samprogna Mohor, Marcelo Enrique Seluchi, Carlos Afonso Nobre

First published: 20 May 2018 | https://doi.org/10.1002/hyp.13154

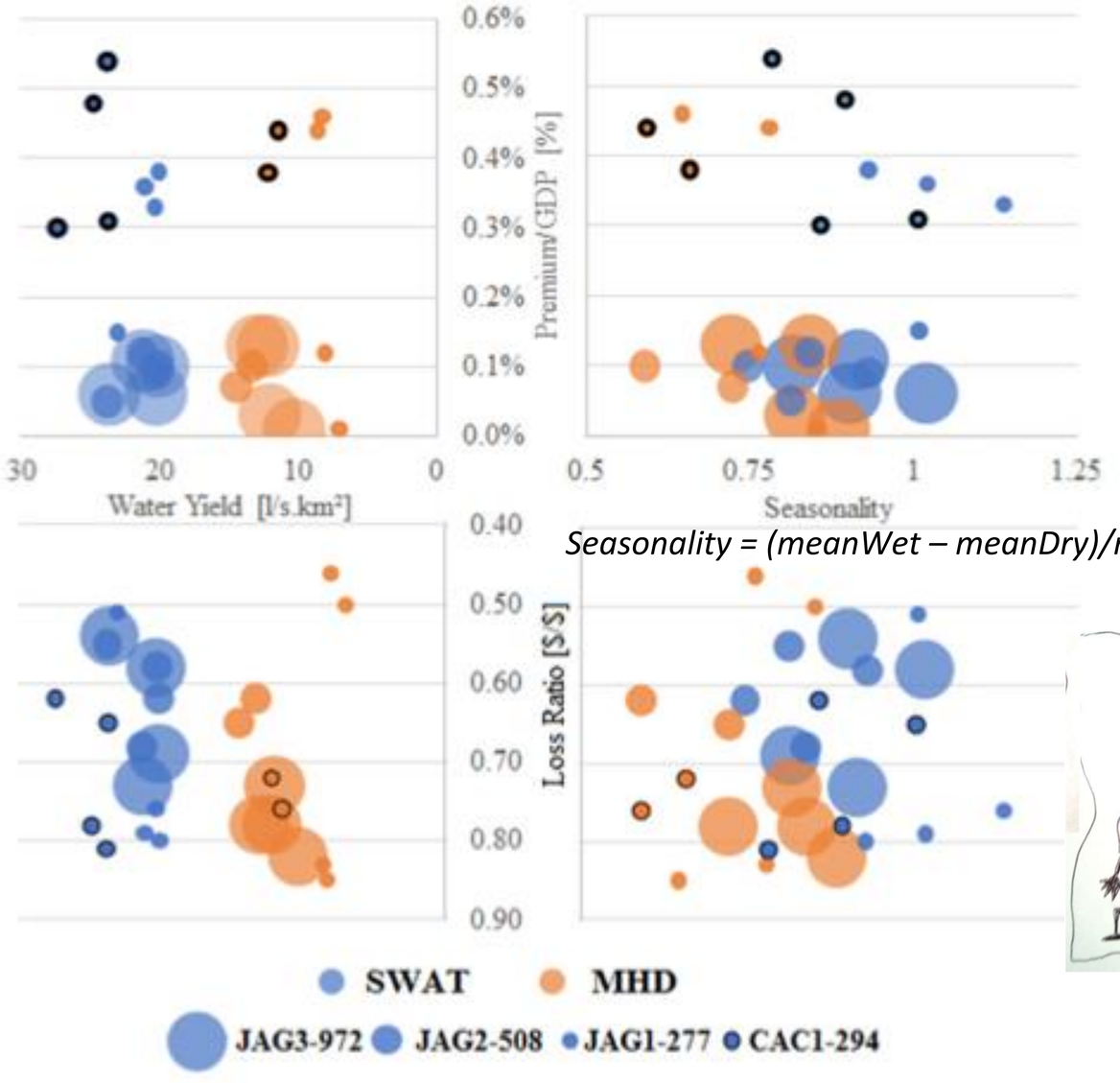




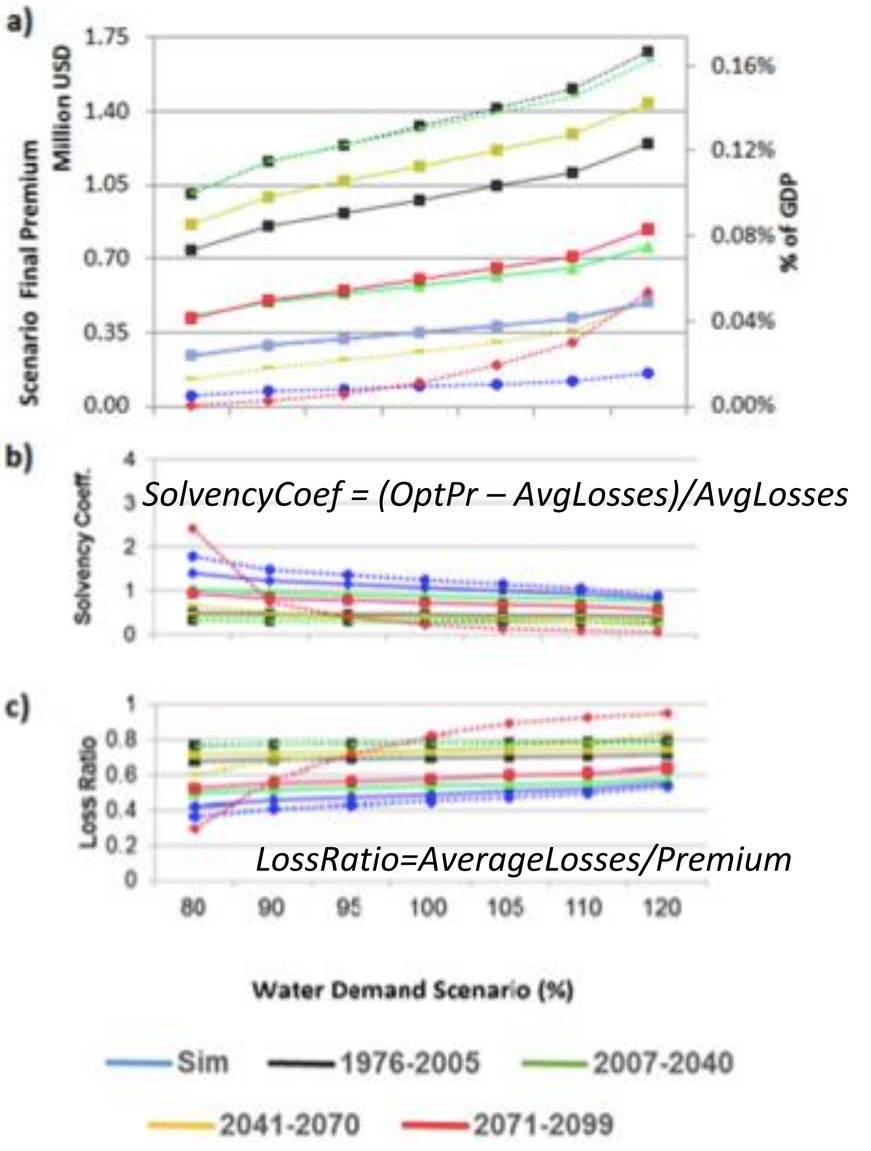


** Projected economical impacts of climate change on water utility company revenue from a 2800-km2 supply system, in Southeast Brazil (Sao Paulo Metropolitan Region), show great range of possibilities for trading off and for developing adaptation strategies of Ecosystem-based Adaptation (EbA) with Payment for Ecosystem Services (PES) supporting WTA insurance.

- Scenarios with MTRH-SHS assess what aging water services could benefit of setting premiums as proxies of WTA.



Seasonality = (meanWet – meanDry)/meanAnnual



SolvencyCoef = (OptPr – AvgLosses)/AvgLosses

LossRatio=AverageLosses/Premium

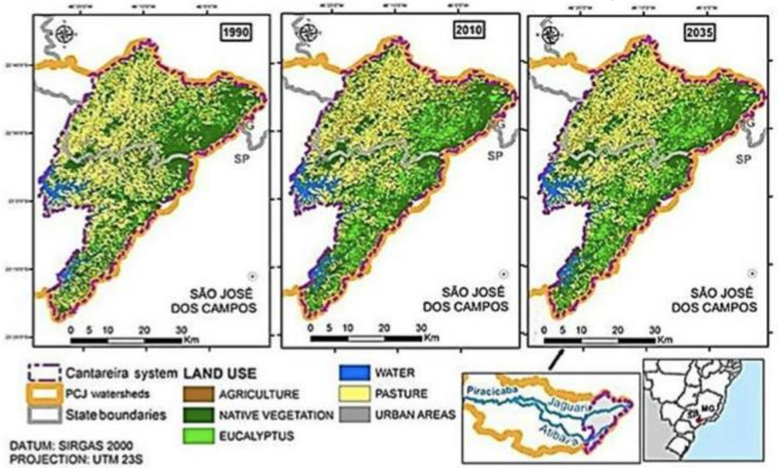
Fig. 6. a) Optimized premiums, b) solvency coefficient, and c) loss ratio for JAG3-972 outlet from SWAT (solid lines) and MHD (dashed lines) outputs.

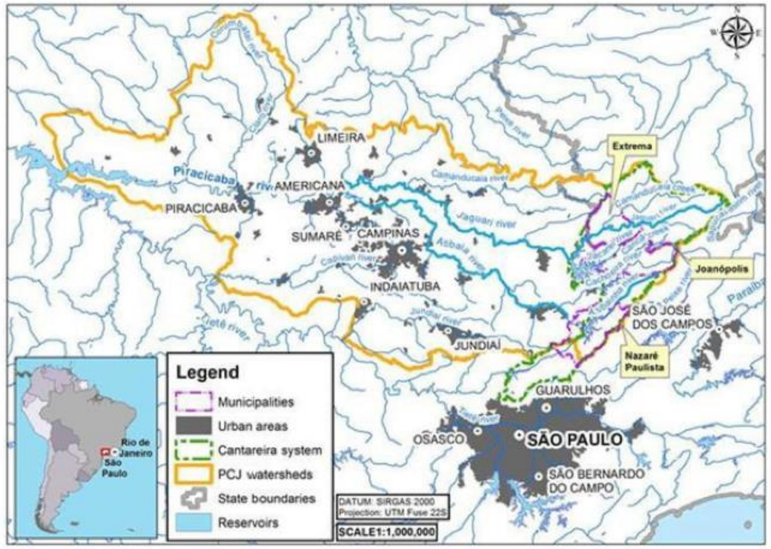
Optimized premiums and loss ratios under hydrologic scenarios driven by climate projections, under current (100%) water demand. Circles area are proportional do sub-basins' areas.

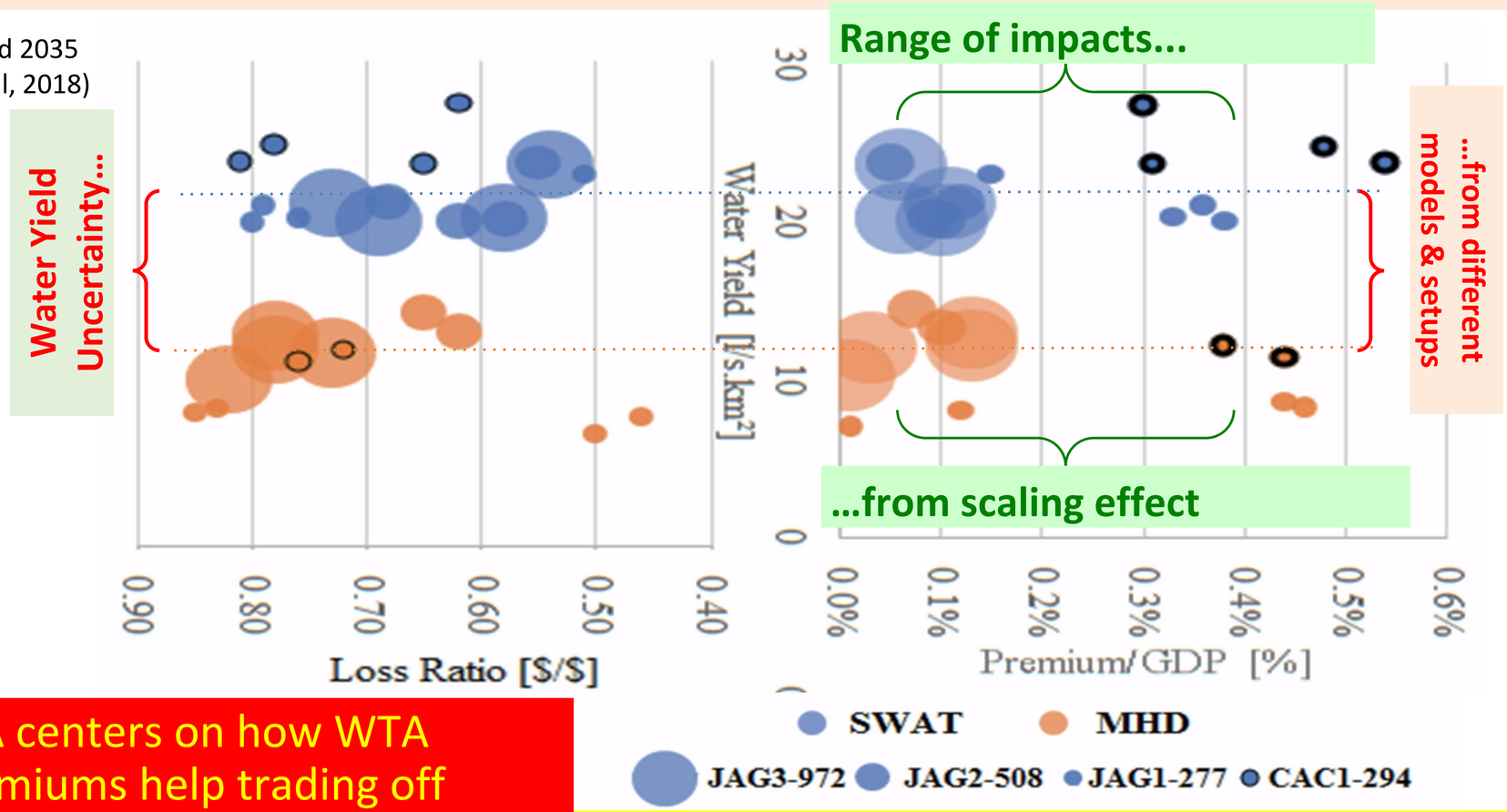
Source: Mohor & Mendiondo (2017), under courtesy permission of Wiley©

Water Yield Uncertainty: Brazilian nested catchments* draining to water supply utilities under climate change scenarios between 2010-2099 show more dependence on outputs from different hydrological models (i.e. SWAT/TAMU and MHD/INPE) than on scales….

Land-use change during 1990 (scenario S1), 2010 (scenario S2) and 2035 (scenario S2 + EbA) in the Cantareira water system (Taffarello et al, 2018)







EbA centers on how WTA premiums help trading off drought crises as kind of Payment for Ecosystem Services (PES) impacting 20 million people of the Brazilian biggest metropolitan area.

…but **resilient mechanisms** (i.e. insurance) depict evidences of heavy influence of different spatial scales* (areas of: 294, 277, 508 and 972 km^2)

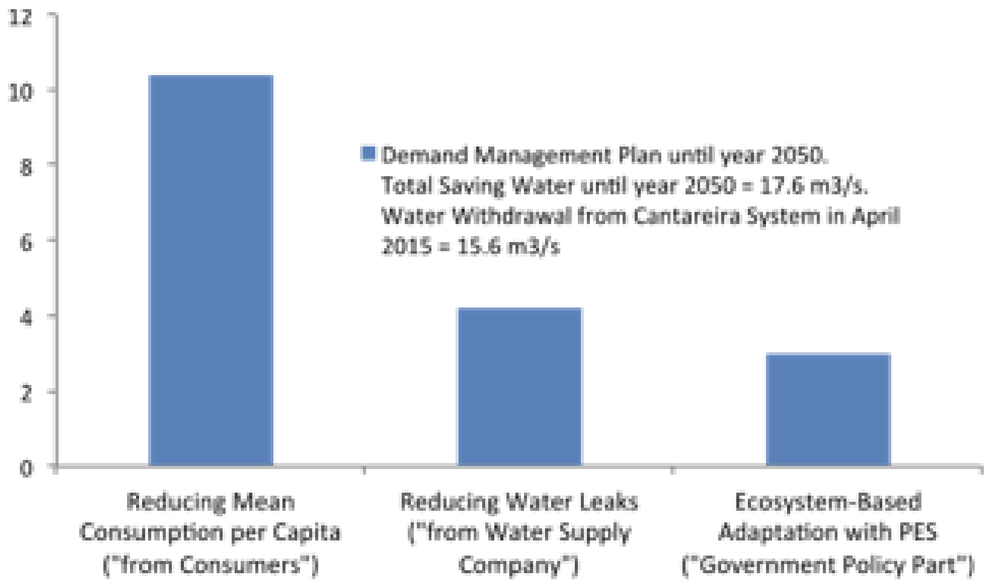
Para Região Metropolitana de São Paulo (RMSP):

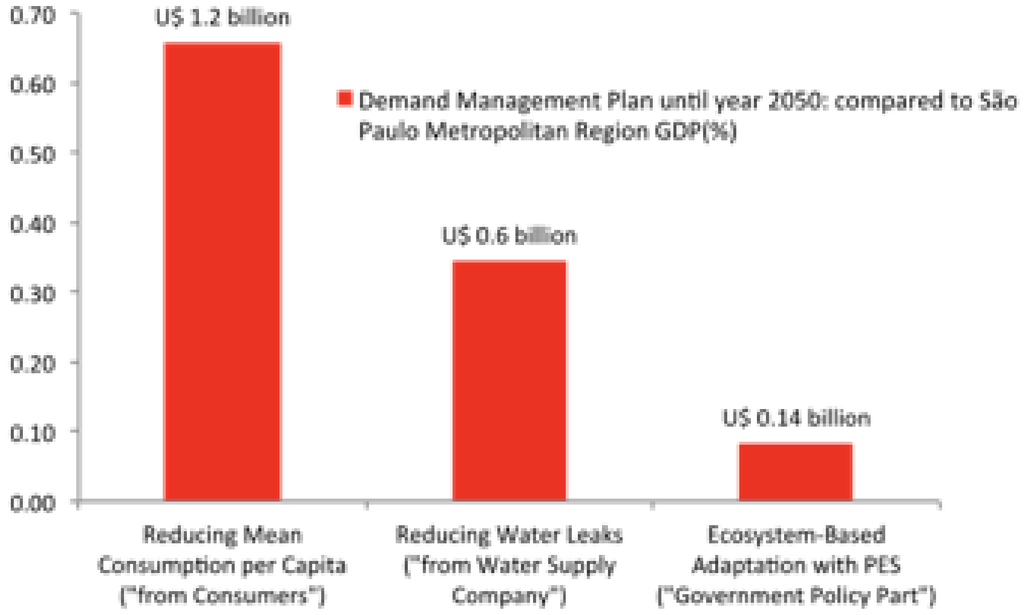
É possível poupar quase um SistemaCantareira com
Gestão de Demanda, através de
Parcerias-Público Privadas (PPPs), com aprox.
1,5 % do PIB da Região Metropolitana de São Paulo (RMSP).

Ao mesmo tempo, os investimentos em infraestrutura hídrica,
hoje contabilizados de até R$ 1,5 bilhão para RMSP,
Não incorporam elementos de saneamento como:
- Novo tratamento da poluição difusa (+ R$ 2,3 bi),
- Infraestrutura resiliente a mudanças climáticas (+ R$ 4,5 bi)
- outros

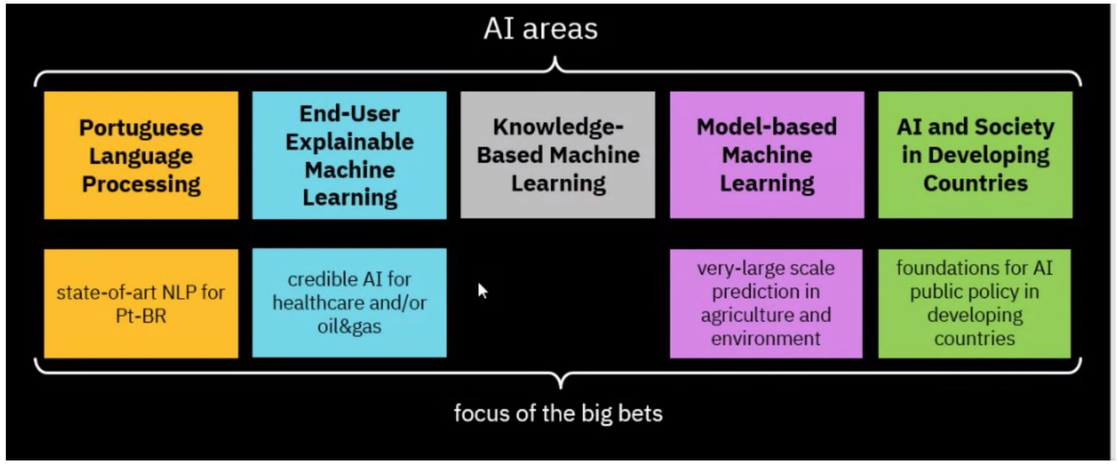
Seguros ambientais e transferência de riscos são necessários
Incluindo bancos, EBTs, institutos, centros especializados,
Empresas de saneamento básico (públicas-privadas)

Nicho de oportunidade de investimento 2020-2035: + R$ 180 bi





How to cope with COVID-19 post pandemic impacts? Public-Private Partnerships guided through science-driven methods and agreement



Thank you

Eduardo Mario Mendiondo
emm@sc.usp.br
e.mario.mendiondo@gmail.com
Skype: eduardo.mario.mendiondo
The WADI Lab
Water-Adaptive Design & Innovation Lab
Sao Carlos School of Engineering
University of Sao Paulo – Brazil
www.eesc.usp.br/ppgshs

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