Session B2:
Growing thirst –
managing water in megacities

Water and Wastewater Management in megacities – the Lima example

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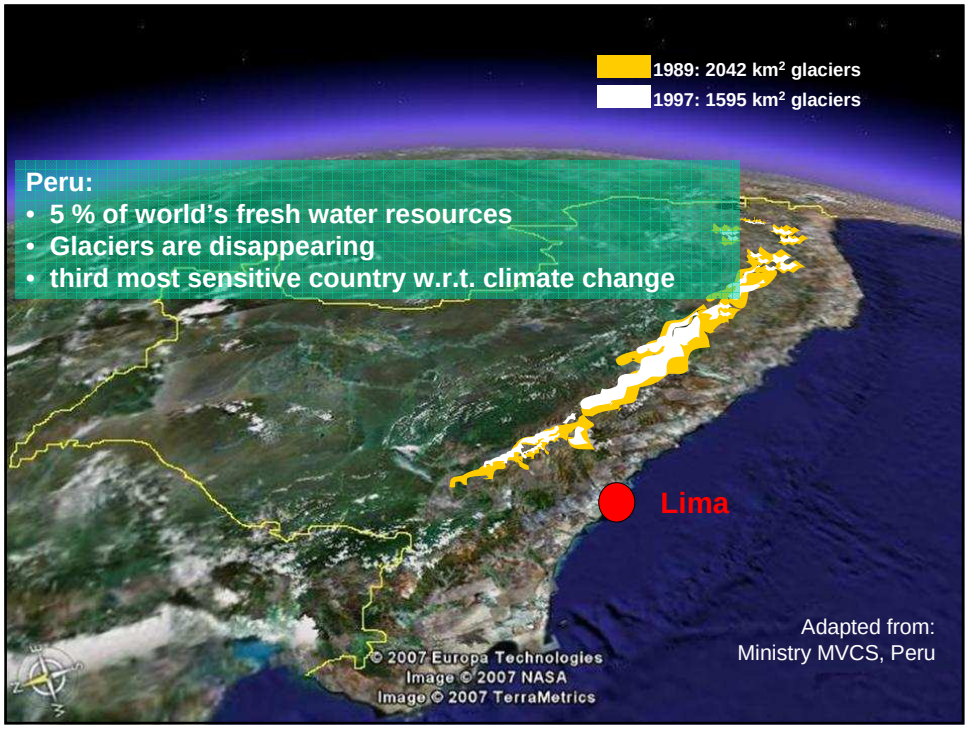
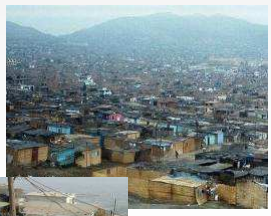


Introduction: Lima

The urban growth centre of Lima Metropolitana, Peru:

- 8 million inhabitants, annual population growth: 2 %
- Second-driest city of the world (9 mm annual rainfall)
- Water supply mainly from the Andes, some groundwater abstraction
- Institutional setting: many different institutions responsible for water



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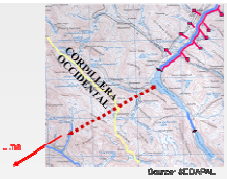
Urban growth centre Lima: Water challenges

- Water
  - Water scarcity; Glaciers, Trans-Andean tunnels
  - Water supply: River Rímac and increasing groundwater abstraction (ca. 20 m3/s)
  - At present: only 15 % of wastewaters treated (SEDAPAL, 2009)
  - some irrigation reuse
- Energy
  - Hydropower generation affected by glaciers
  - Operation of water/wastewater infrastructure
  - Conflicting water uses: supply, hydropower, fishing, mining




Water lorries for 20 % of population


Rio Rimac after abstraction

Water reuse in some parks

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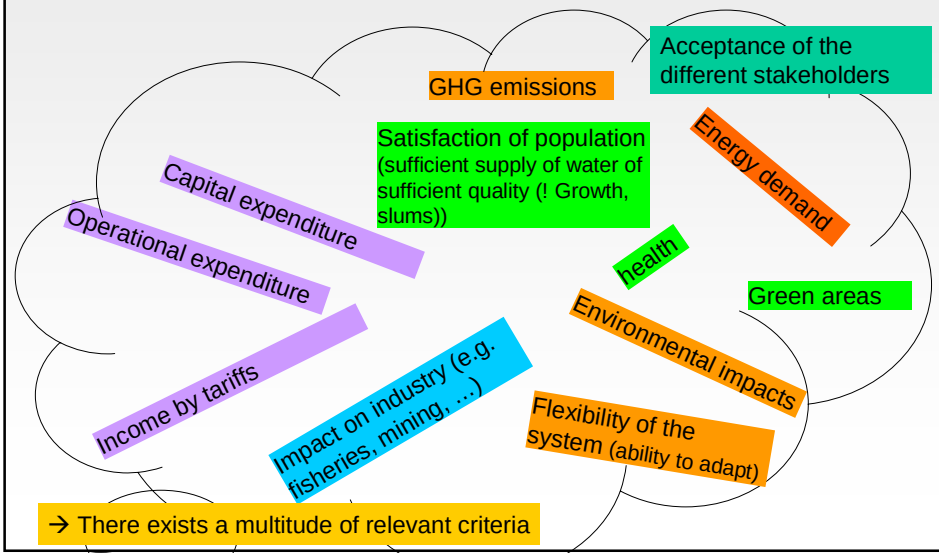
Potential criteria to assess metropolitan water systems and their sustainability



How to deal with the water system?

- **Potential options and measures** to **adapt to climate change**
  - Structural measures (infrastructure projects), e.g.
    - Additional reservoir lakes (for water supply and energy production)
    - Plants for **reuse** of wastewater
    - Leakage reduction, water-saving devices (e.g. dual-flush toilets)
    - Expansion of existing infrastructure (e.g. drinking water networks)
    - Improvement of existing plants
    - Desalination plants; Fog-catchers; water sensitive urban design
  - Non-structural measures, e.g.
    - (Real time) control (resulting in better, more flexible use of existing infrastructure) – reservoir lakes, GW wells, distribution, plants, …
    - Awareness-raising campaigns
    - Changes to water tariff structure, metering
    - Capacity building of experts and decision makers
  - And many more

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Partners of the LiWa project

- Peru
  - SEDAPAL S.A.
  - Universidad Nacional de Ingenieria
  - Foro Ciudades para la Vida
  - FOVIDA
- Germany
  - ifak e. V. Magdeburg (Coordinator)
  - ZIRN, University of Stuttgart
  - IWS, University of Stuttgart
  - Leuphana University Lüneburg
  - Dr. Scholz & Dalchow
- www.lima-water.de

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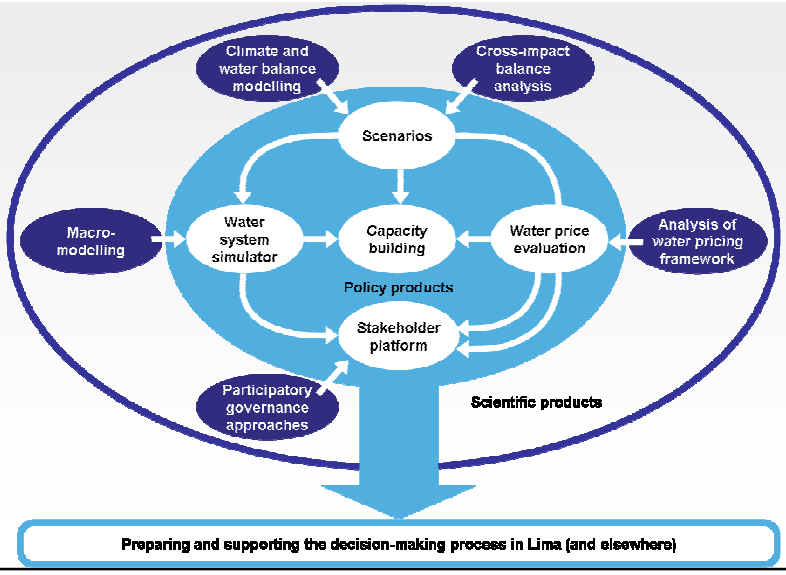
Methodology and products of LiWa



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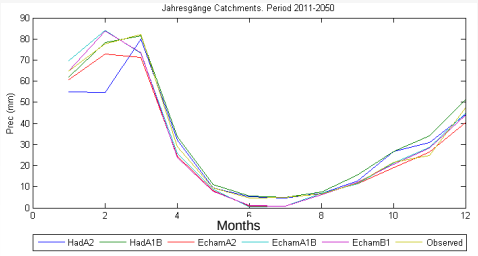
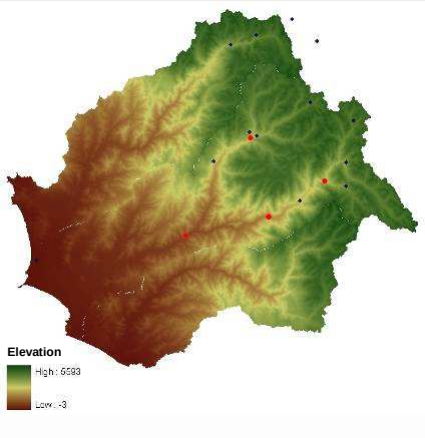
What happens in the catchments?

- Climate model regionalisation
- Water balance in river catchments
- Catchment runoff as input to modelling the urban water system



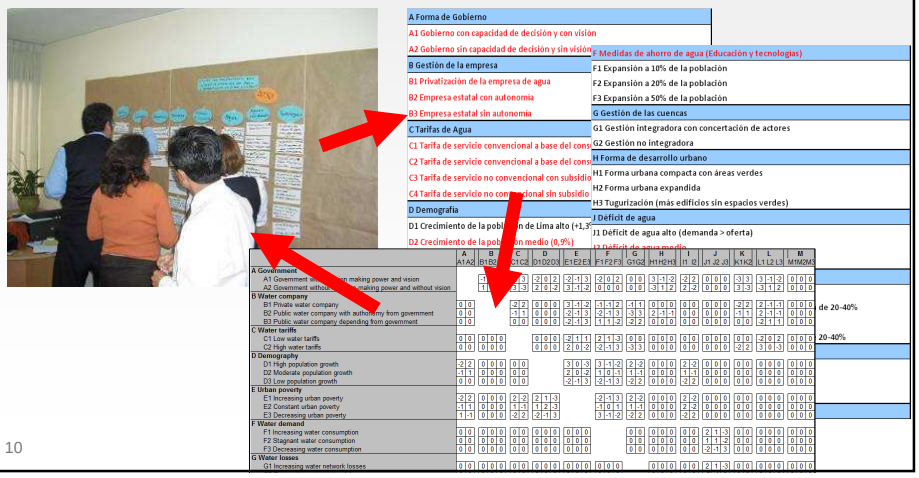
- Annual precipitation pattern



Which are possible futures of Lima? Scenario building

Scenarios = possible futures

- Identification of most important descriptors, derivation of scenarios



Progress and Products:
Cross-impact balance and scenario building

Variables describing the water sector in Lima (“descriptors”):

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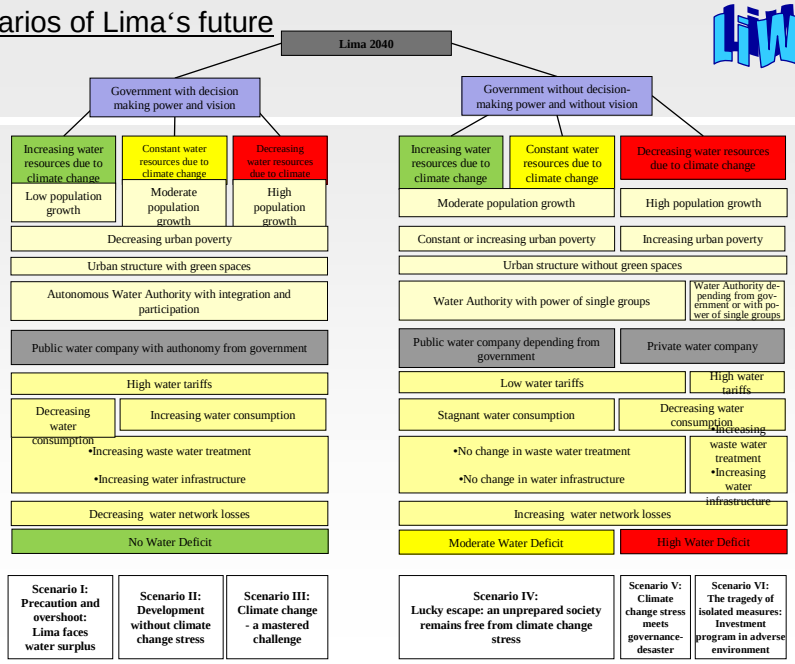
Scenarios of Lima‘s future



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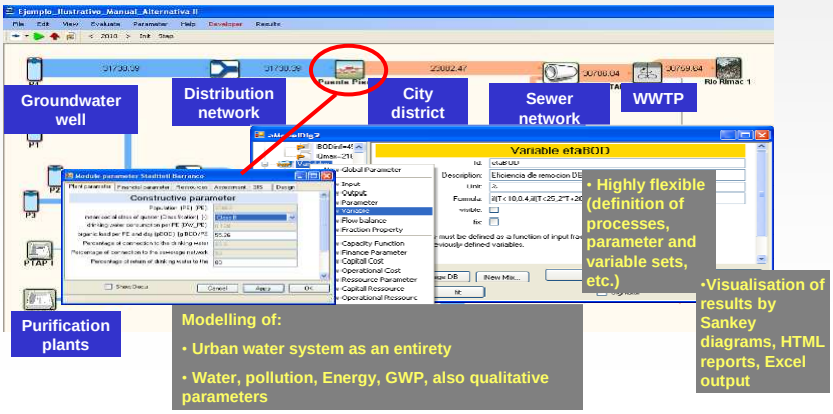
Modelling for sustainable water management in Lima

- Macromodelling: Representing the entire water and wastewater system of Lima in one single model
- Ressource fluxes: water, quality; Energy, expenditure, revenue



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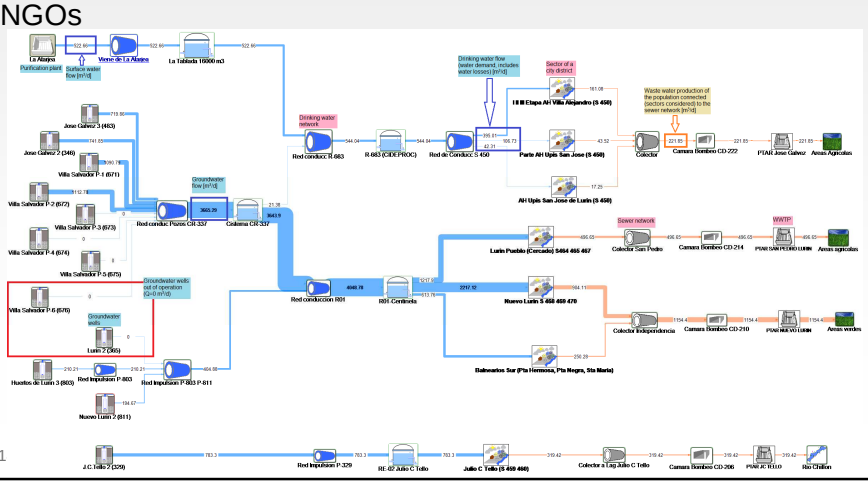
Modelling for sustainable water management in Lima

- District of Lurin and Southern seaside towns (63000 inhabitants)
- Real-life example, close cooperation with water companies and NGOs



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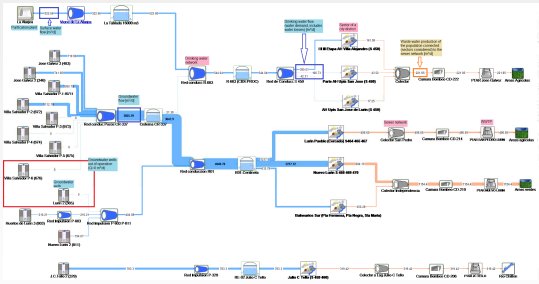
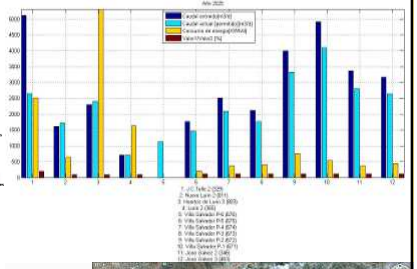
Water system simulator: Application for Lurin

- Water supply mainly by groundwater
- Change of groundwater pumps operation => Better supply, energy savings





Escenario	Descarga promedio anual de DBO al Río Lurín (Kg/año)[1]	Consumo promedio anual de energía [kWh/ año] en todo el sistema	Ratios de extracción teóricos de los pozos (año 2025)[2] (-)	Caudal promedio anual de agua residual (m^3/ año)	Ingresos promedio anuales por tarifas (PEN/año)
Estado Actual (año 2006)	14.780	20.937.250	-	800.200	1543530
Escenario A	74.649	96.064.188	-	4.042.153	6.931.916
Escenario B					
- Estrategia 1	74.649	93.400.143		4.042.153	6.976.758
- Estrategia 2	74.649	93.329.608[4]		4.042.153	6.976.758

BOD[kg] kWh Flow revenue

Application of modelling results in stakeholder discussions

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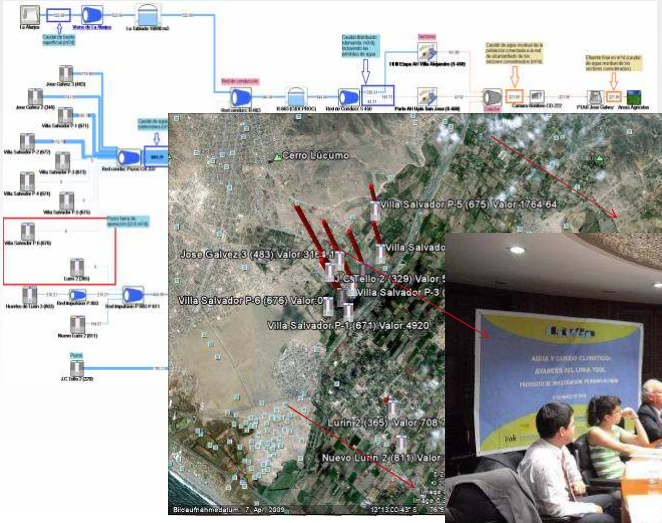
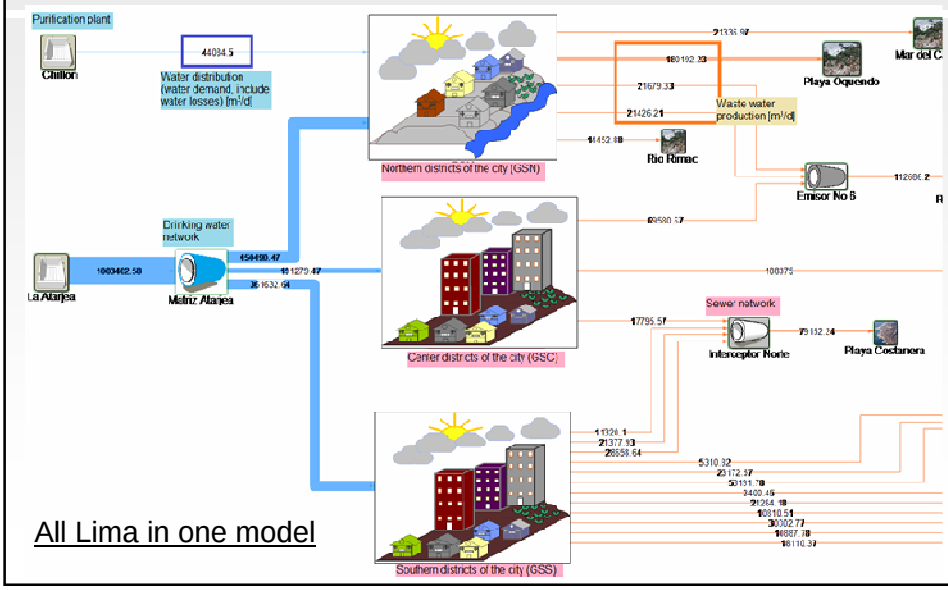


„LiWatool“

Visualisation

Next application:
All of Lima Metropolitana



All Lima in one model

Water system simulator

- Simulator: high degree of flexibility, user can modify/extend models himself (XML-file based model and data description);
- Water tariffs considered, yet in a simplistic way
- Round table discussions with stakeholders in preparation
- -> Informed discussions and participatory decisions

Additional contributions to sustainable water management in Lima

- Detailed analysis of water tariffs
- Capacity building measures:
  - training courses (for partners) on modelling
  - Professional training course on water management
  - Interdisciplinary Student exchange (both ways)
- Detailed research on wastewater treatment
- Detailed research on control of water systems
- Liaison with DWA (German Water Association): Water reuse guidelines
- Prototype greywater reuse system at Gutenberg School in planning

Gutenberg School, El Agostino

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