URAdapt

Managing Water at the Urban-Rural Interface: The key to climate change resilient cities

Urban water balance modeling in VENSIM and findings from the PhD research

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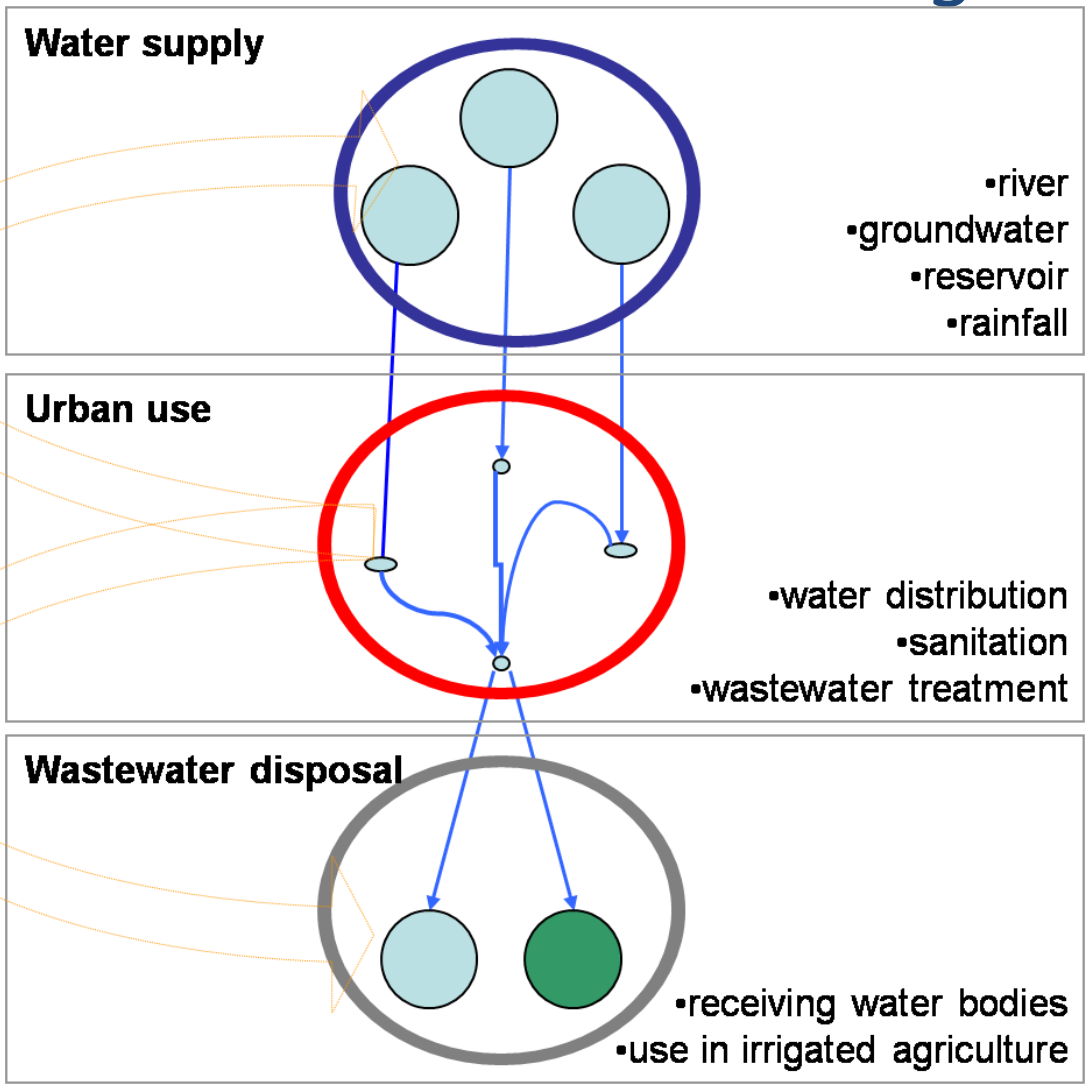
Objectives

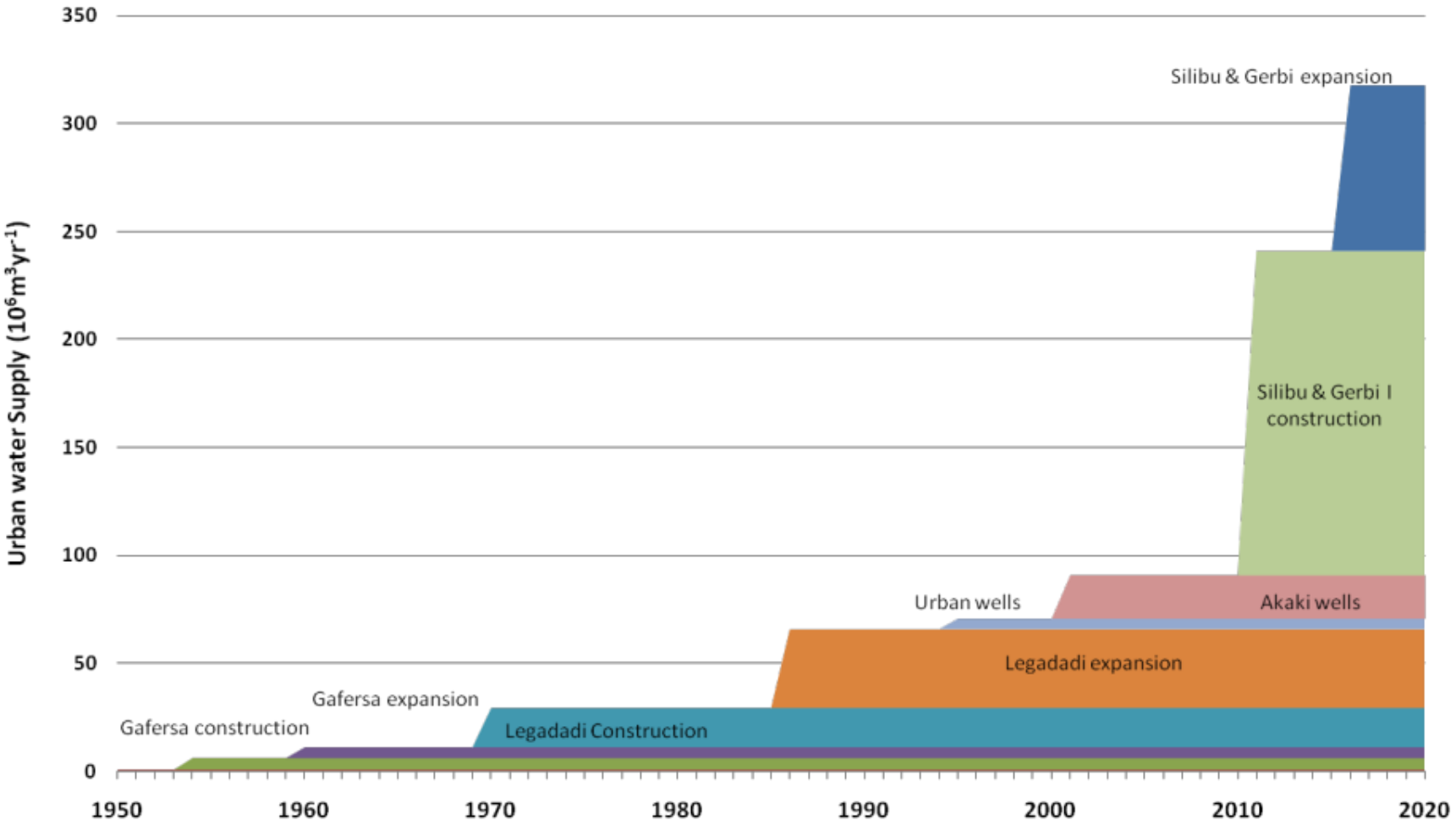
- To generate needed knowledge and deeper understanding of urban water system and vulnerability
- To process demographic and water supply and demand scenarios
- To rationalize the discussion on climate change risks
- To provide decision support

Addis Ababa Urban Water System.
What water are we talking about?

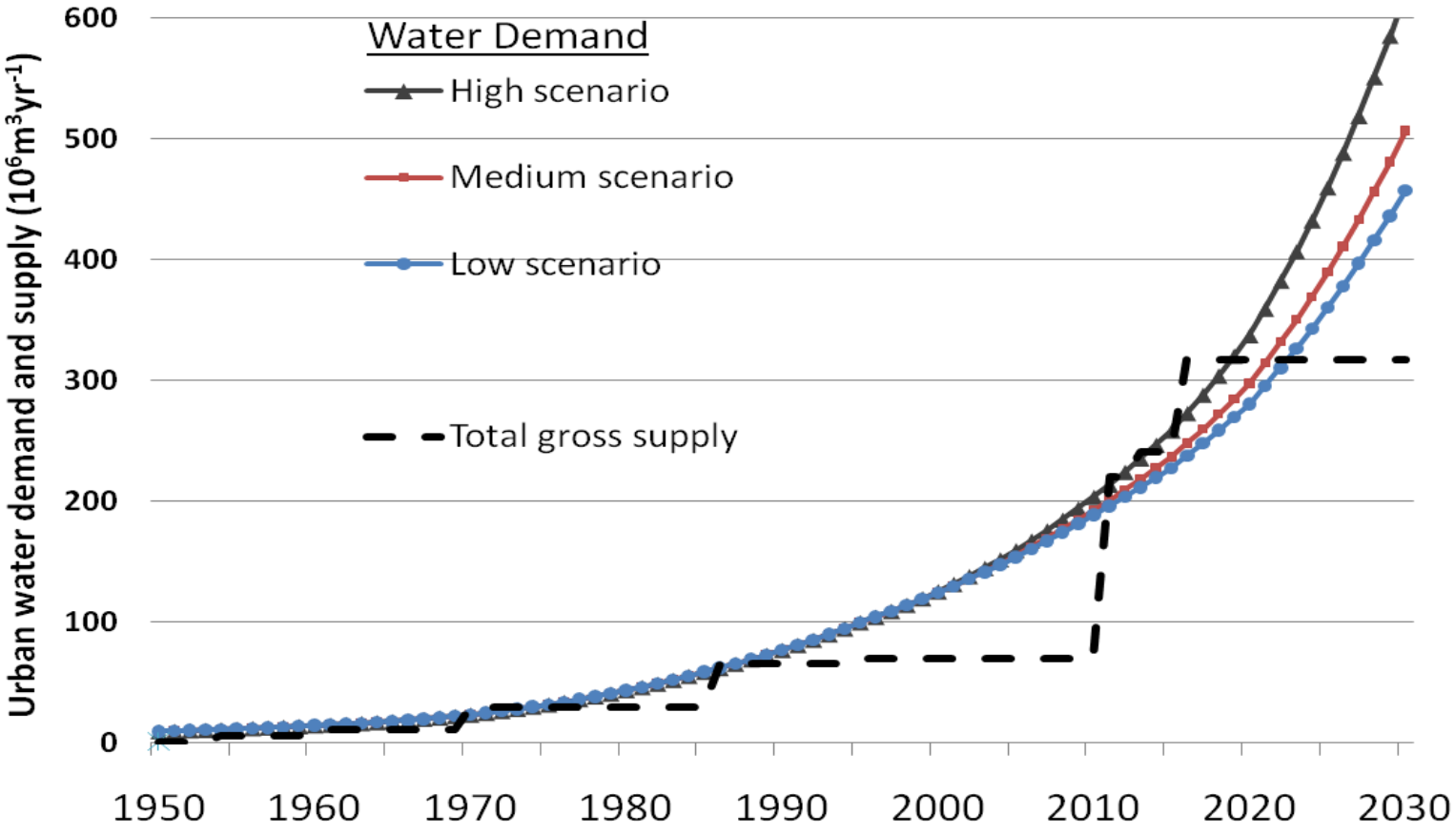
Disposal



Water Supply to Addis

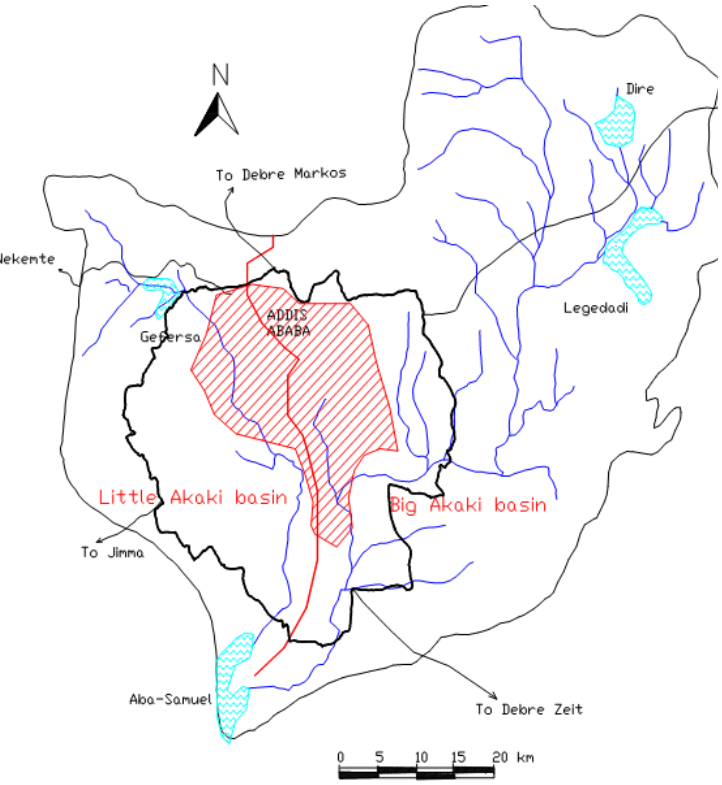


Urban water demand vs supply

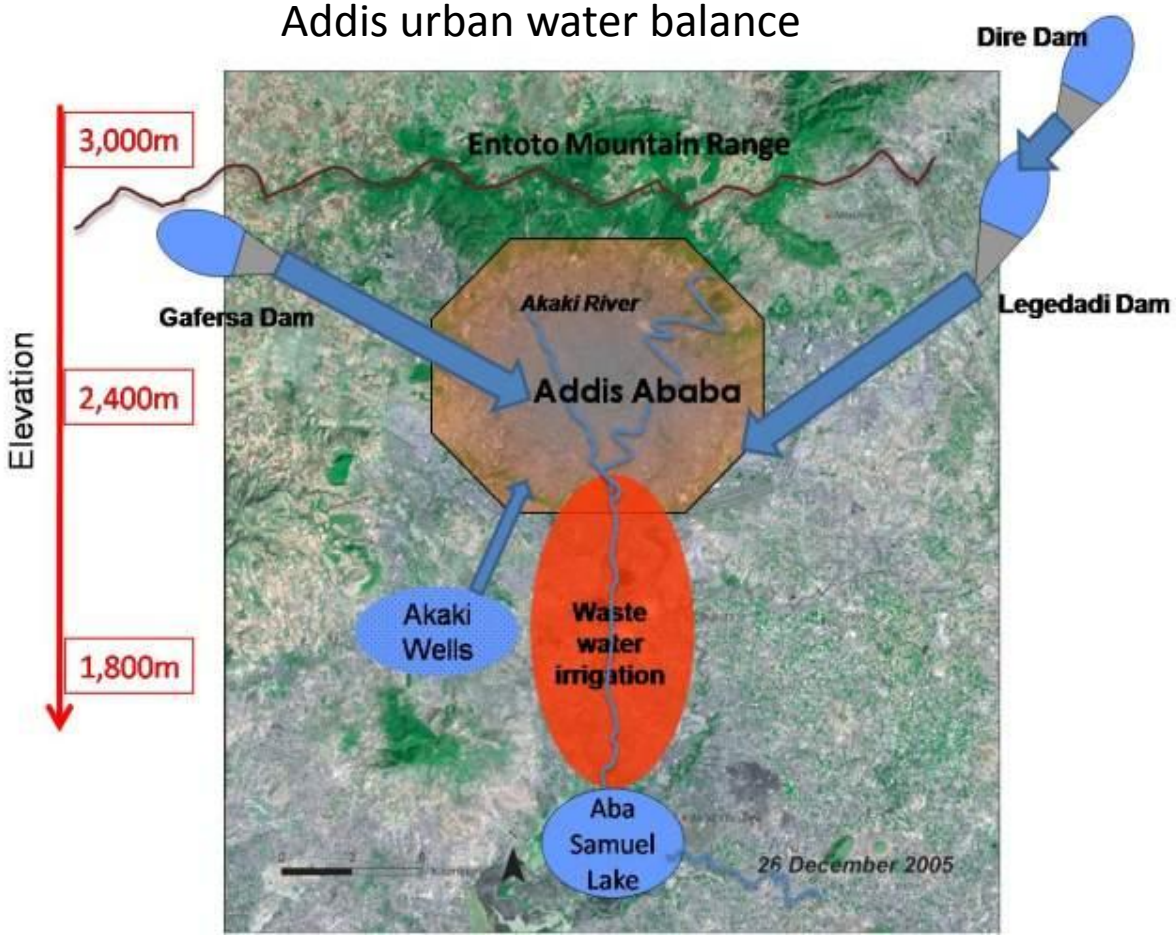


Impacts Climate Change on Urban Water Balance

Addis urban catchment



Addis urban water balance



Fraction urban water use of run-off generated in the basin

Basin	Annual basin run-off	Urban use		Irrigation potential
	$10^6 m^3 yr^{-1}$	$10^6 m^3 yr^{-1}$	% of Run-off	ha
Awash	4,900	90	**1.84**	134,121
Abbay	54,800	250 (planned)	**0.46**	815,581

CC impact scenarios in relation to the working of the model

CC Scenario: Rainfall events becoming more intense and frequent (city level)

Impact: More severe and frequent flooding in urban areas. Increased health risk due to mixing with untreated domestic wastewater.

Modeling results that can help develop adaptation strategies :

- Improving drainage system will reduce flood volume by X% (government)
- X% potential flood reduction through rooftop water harvesting (households)
- X% storm water reduction by increasing fraction green areas in the city, to improving infiltration (government)

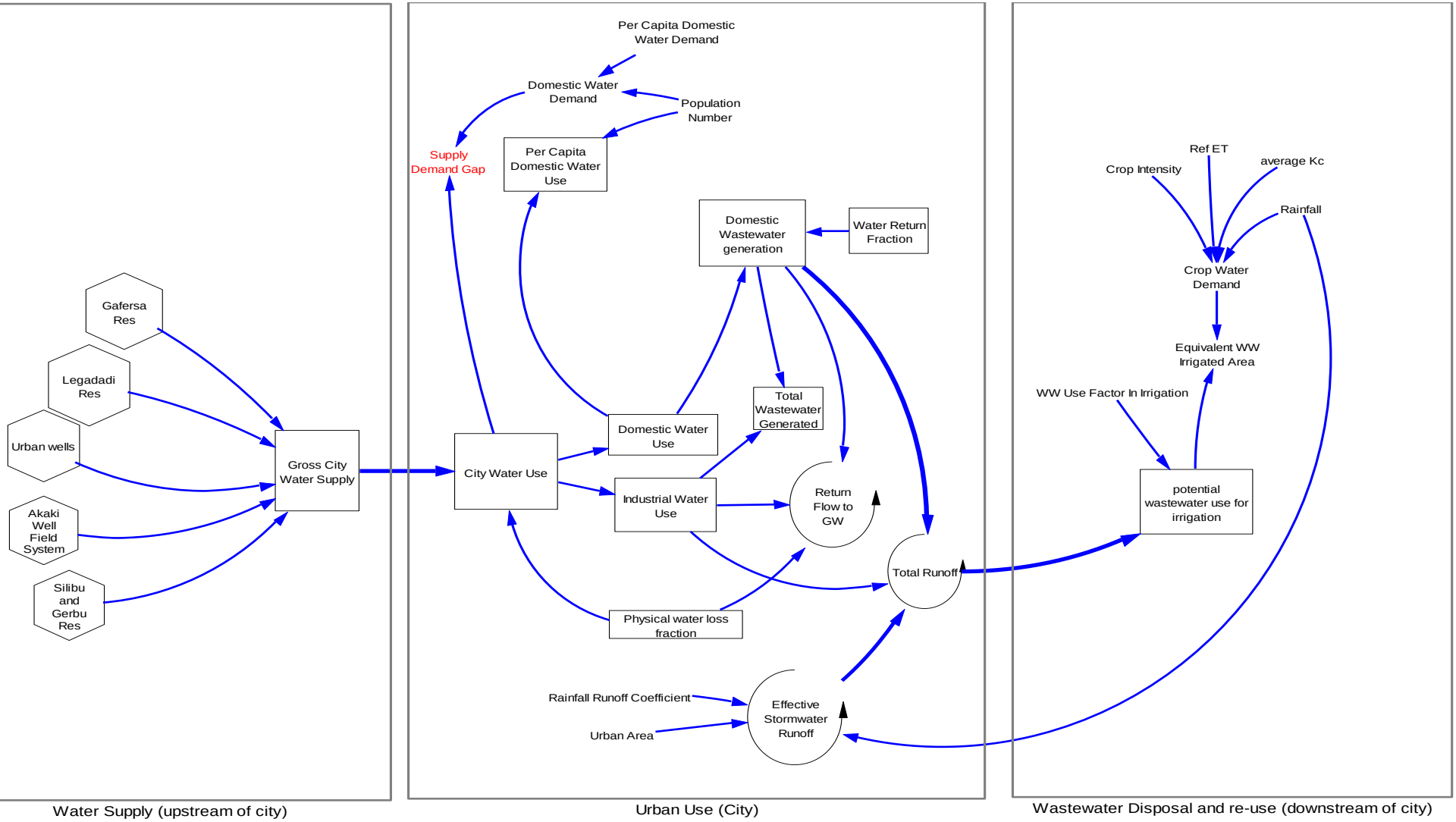
CC Scenario: Dry periods becoming more severe (drier) and recurring more often (catchment level)

Impact: Low water availability for all water use sectors.Reduced urban water supply.

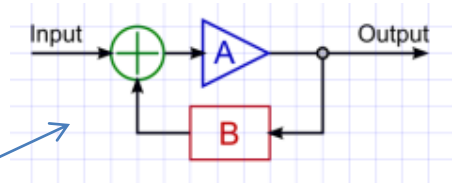
Modeling results that can help developing adaptation strategies:

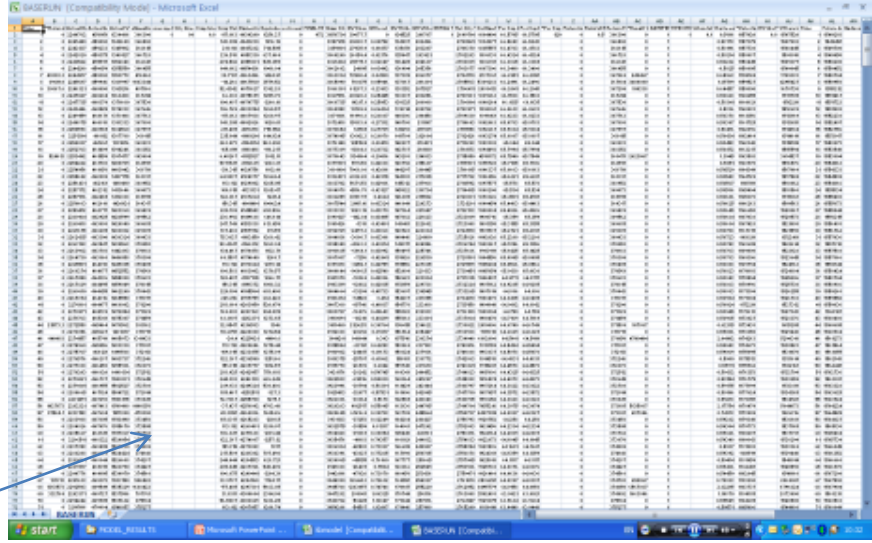
- Potentially X% of rainwater saved through rooftop rainwater harvesting (household)
- Shift X% of water use to more reliance on groundwater (city)
- Reduce physical losses by X% (utility)

VENSIM Model structure

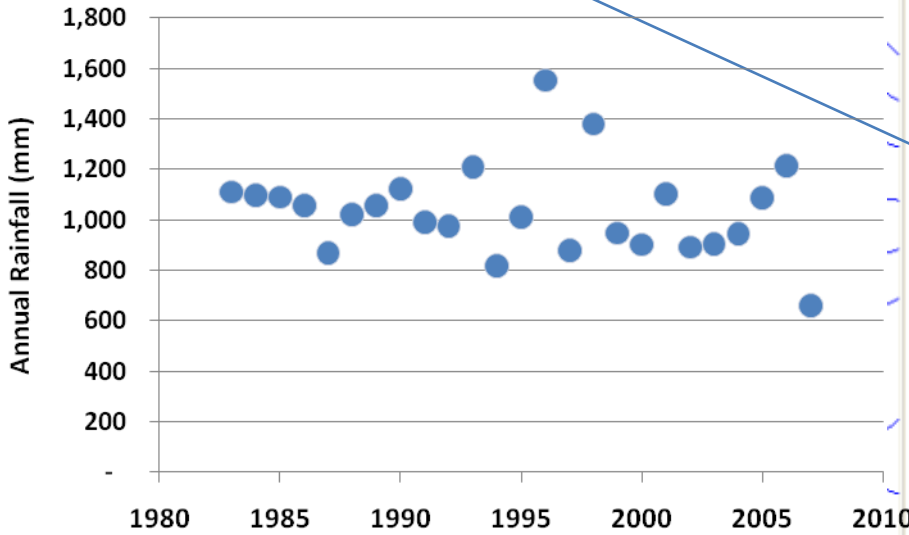


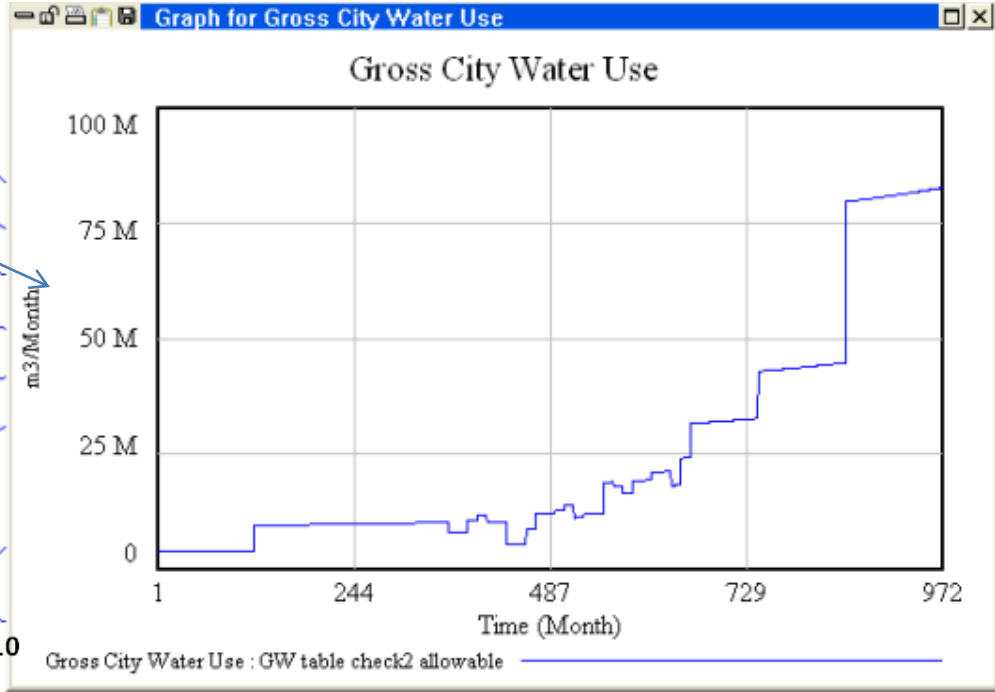
Model properties





- System Dynamics
- No feedback loops applied – this is ‘one flow through’
- Time series data input (ET, Rainfall, water supply etc)
- Outputs as xls format or VENSIM graphs





Outputs for the project

- Urban Water Database
- Scenarios
- Impact assessment (through modeling)
- Urban Water model (part of decision support)

Preliminary model outputs for:

- City level wastewater generation
- Stormwater runoff

PhD findings 1/2

City:

- Urban water stress: low per capita use and supply driven water supply
- City authorities constrained in their daily and structural operations: constrained financial and institutional capacities

Upstream:

- Source expansion of water supply: inter-basin transfer from Abay Basin, groundwater
- Siltation of reservoirs, threat to water availability
- Catchment development: agricultural and domestic water demands

PhD findings 2/2

Downstream of city:

- Re-use in irrigated agriculture - vegetables
- Pollution of Great and Little Akaki River with industrial effluent and domestic wastewater
- Health concerns for humans and environment

Data needs for model refinement

- Informal water use (from groundwater)
- Urban expansion (historic and projected)
- Land use maps for Addis and Oromia region (built-up vs green and water)
- Historical development of sanitation facilities (breakdown by type of facility)
- Plans for urban water supply expansion

Planning of WP2 Activities

- *Inventory of available climatic and hydrologic models (properties and usefulness) (completed)*
- *Define main scenario types (ongoing)*
- *Data collection: climatic data generated from downscaled climate scenario results*
- *Data collection: demographic data and urban water system (ongoing)*
- *VENSIM model set-up (ongoing)*
- *Data analysis and modelling of scenarios (planned)*
- *Generating and incorporating input and feedback from platform (planned)*
- *Finalize scenarios and modelling in collaboration with stakeholders (planned)*

Thank you!