Με τη συγχρηματοδότηση της Ελλάδας και της Ευρωπαϊκής Ένωσης

HYDROPOLIS

Water demand management in the expanding urban areas of South Attica

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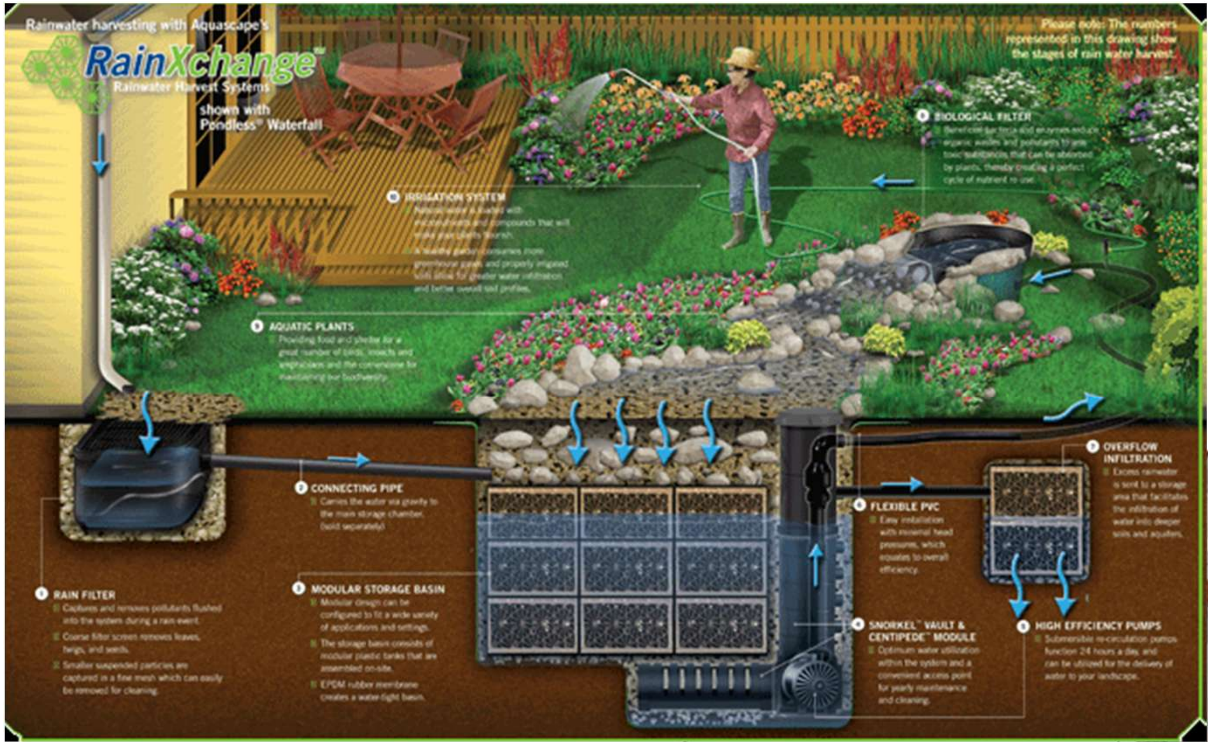
Water demand management and urban expansion

Water demand management (WDM) technologies

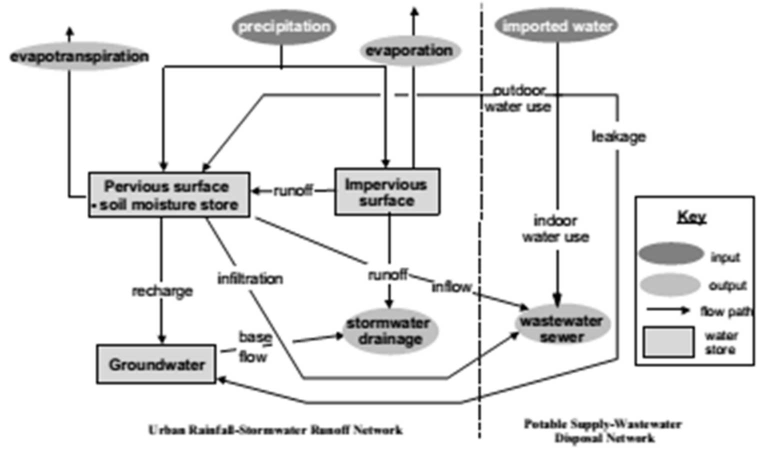


The potential water savings at the level of household can be estimated employing either empirical methods [1] or urban water cycle modelling [2].

Table 4.4: The greywater collection calculations for new dwellings – showers

Litres per minute (a)	Number of fittings present (b)	Quantity using greywater (c)	Greywater supply (d) = (a) x (c)
Total fittings consumption(e) = Sum of (b)		Total greywater demand (f) = Sum of (d)	
Average greywater supply from showers (where bath present)		$= \frac{(f)}{(e)} \times 4.37$	
Average greywater supply from showers (shower only)		$= \frac{(f)}{(e)} \times 5.60$	

Source: See [1]

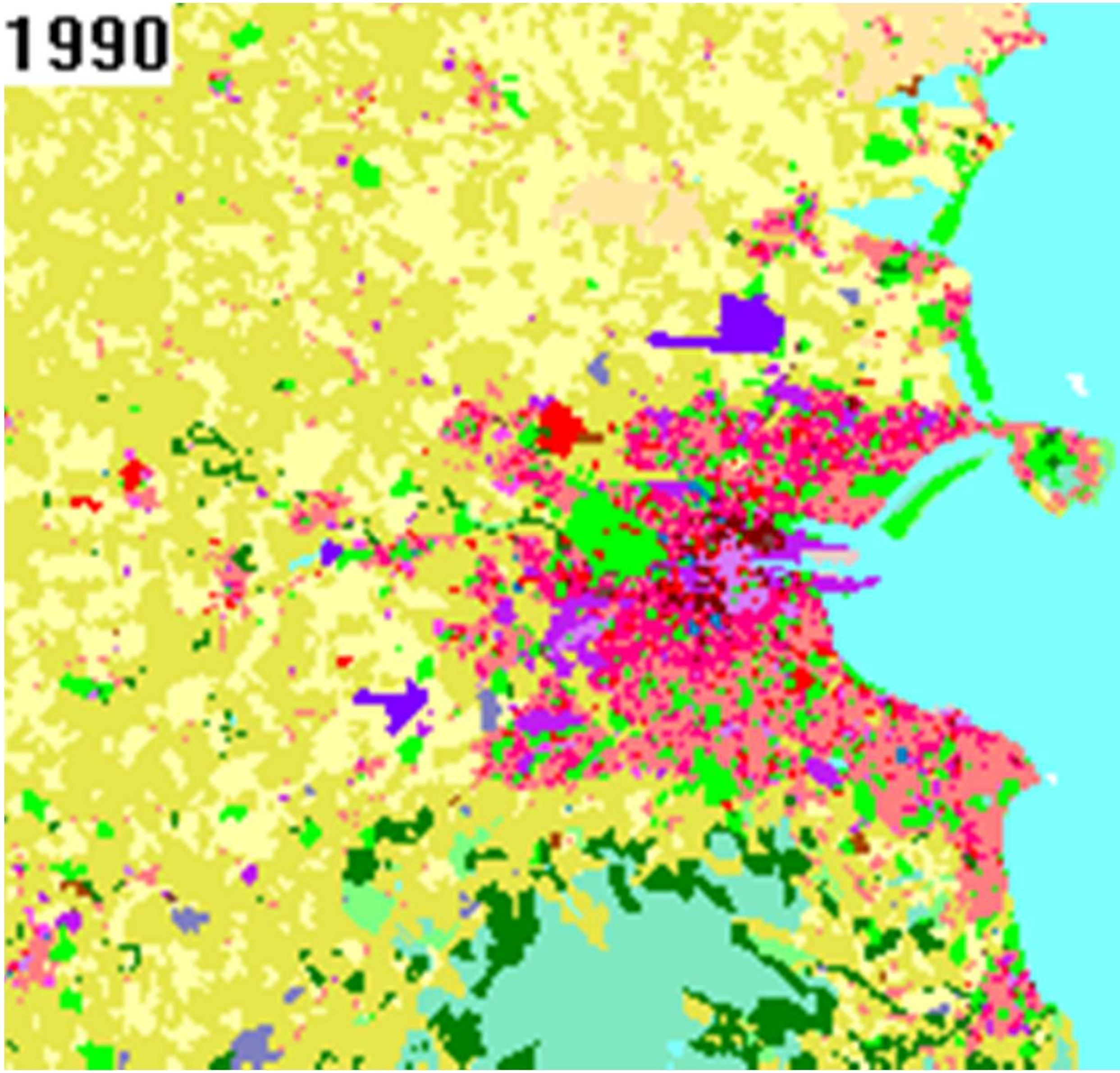


Source: See [2]

The potential water savings at a higher level (e.g. city level) in the case of an expanding urban area is not straightforward, it is influenced by the factors that drive the urban expansion.

Water demand management and urban expansion

WDM at city level – Urban expansion

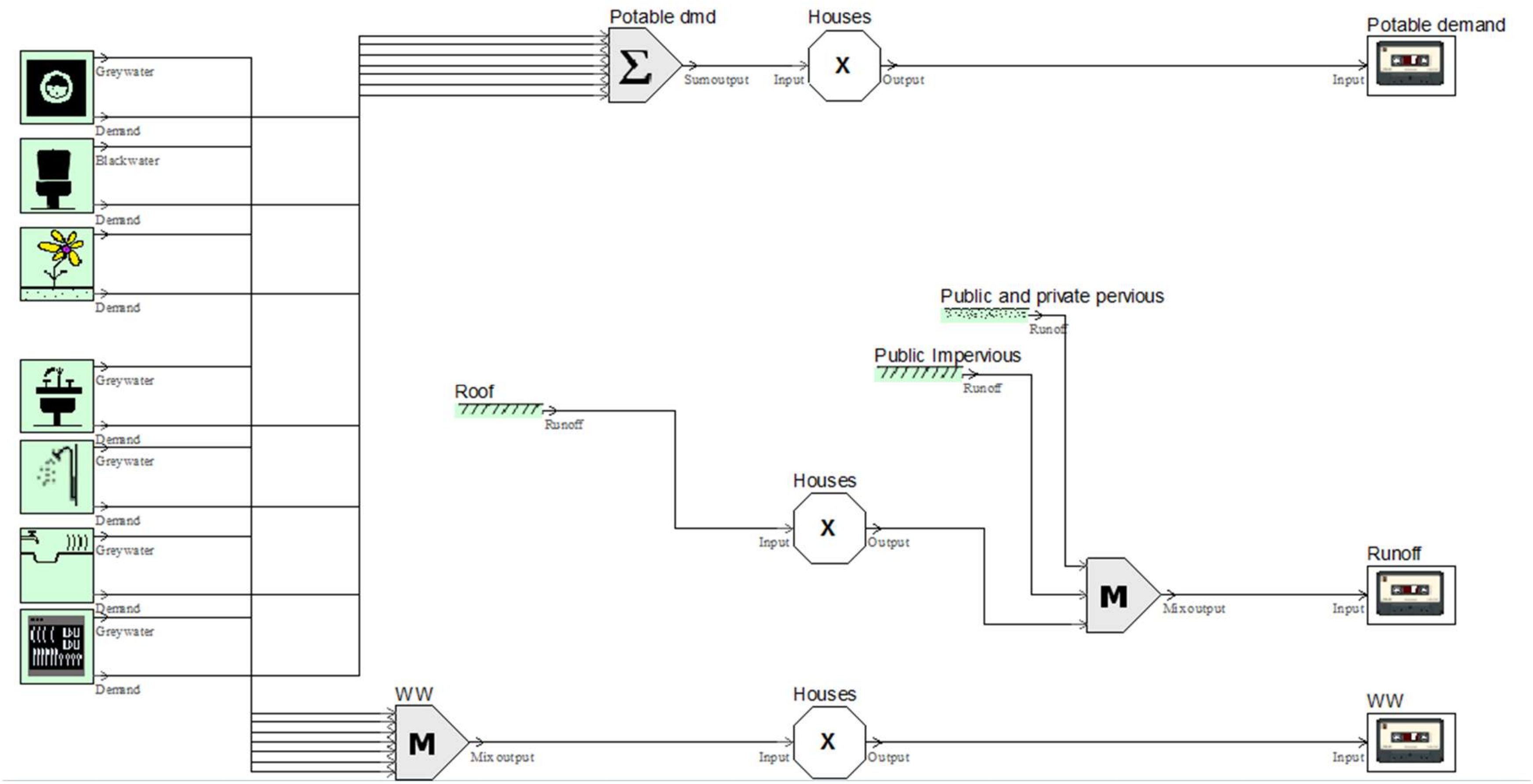


For this reason, a cellular automaton (CA) model, which simulates the urban expansion, is coupled with an urban water cycle model (UWOT), which simulates the urban water flows at the household level.

Two alternative water-saving technological configurations are investigated.

Water demand management and urban expansion

Configuration 1 – low consumption appliances (LOW)



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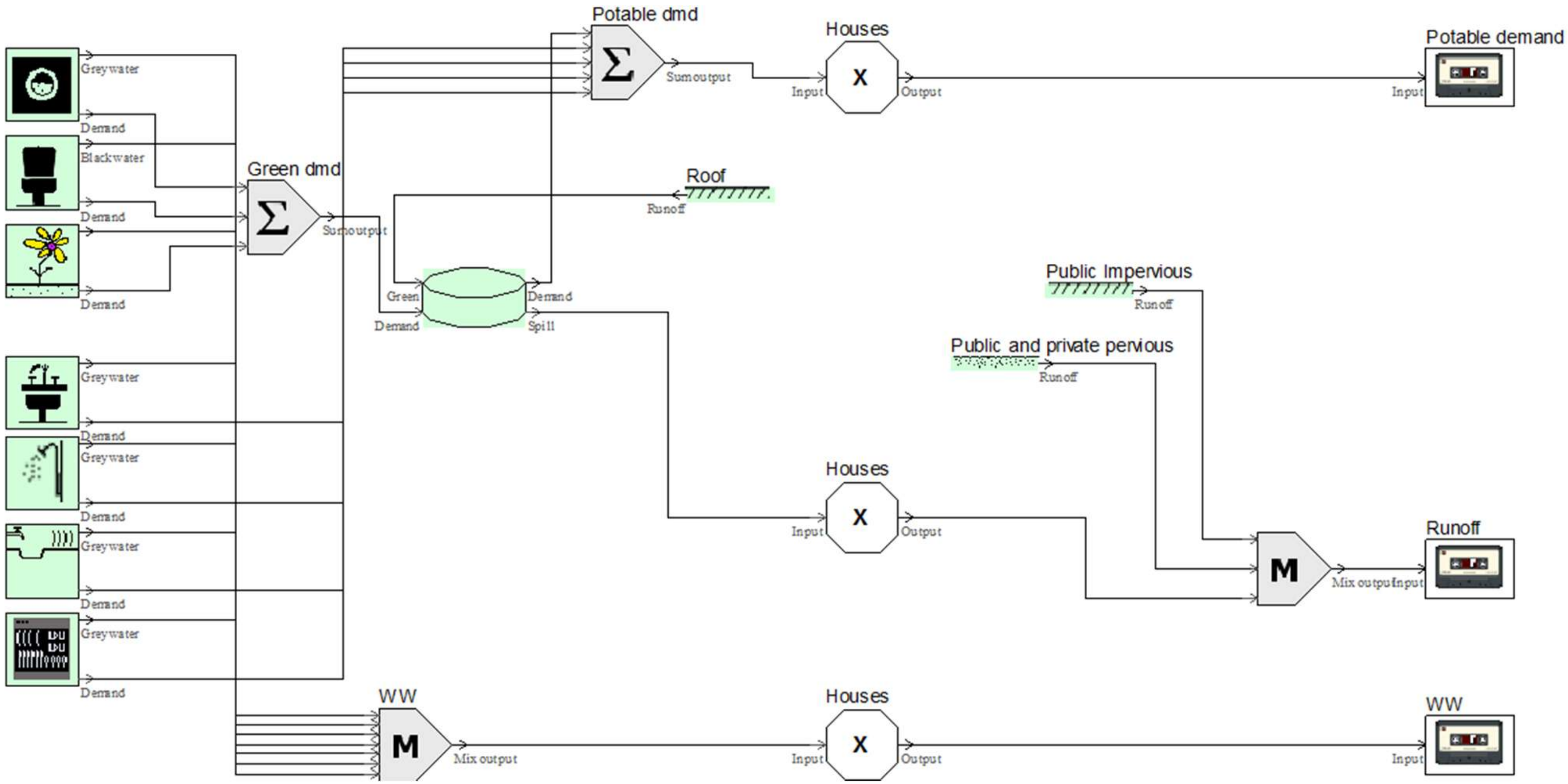
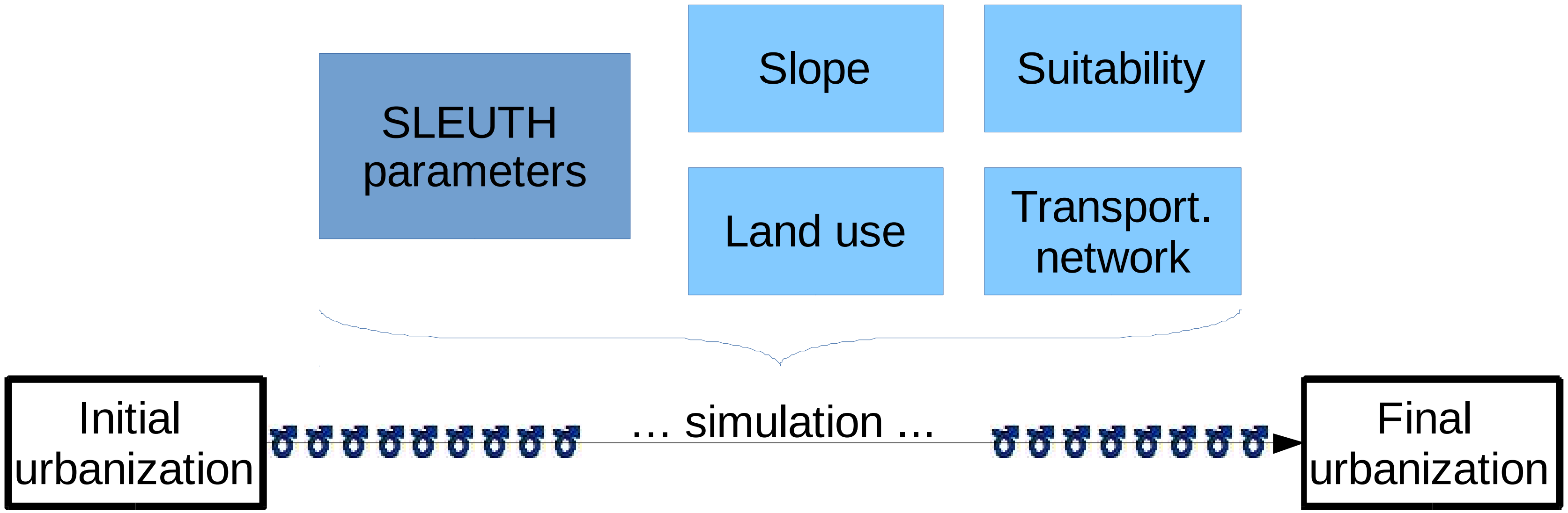
Configuration 2 – rainwater harvesting (RWH)



SLEUTH is a CA model that combines terrain mapping and land cover deltatron modelling to simulate urban development [3].



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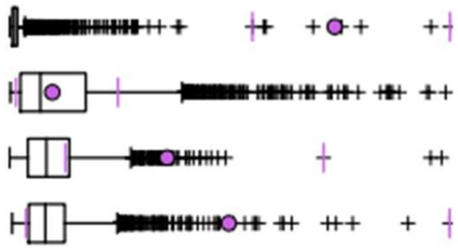
Water demand management and urban expansion

Initial urbanization: studied area classes

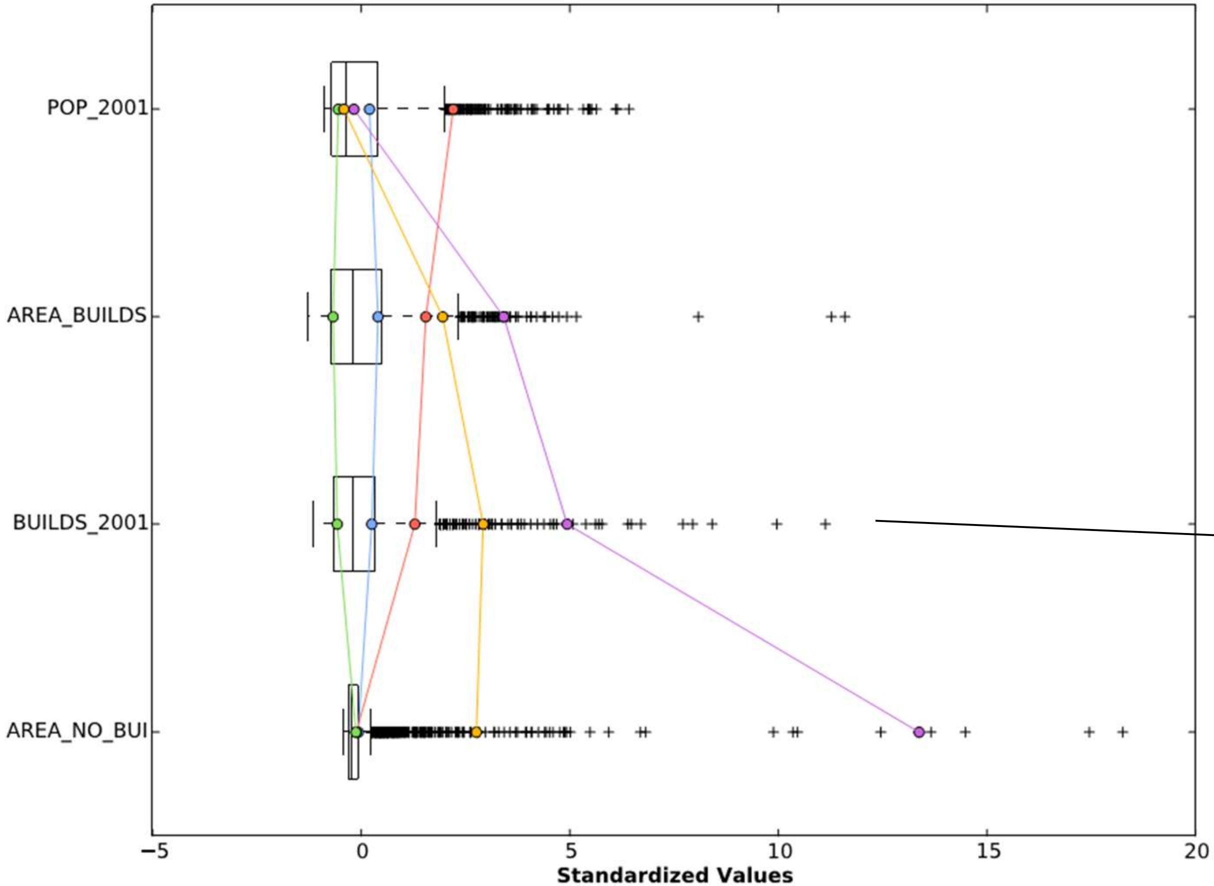
1. Discretize spatially the study area
2. Define the kind of properties
3. Obtain statistical characteristics of studied area

Variable	Mean	Std. Dev.	Min	Max	Share
AREA_NO_BUIL	514195,8553	105738,0815	384097,5462	696161,6913	0,4484
POP_2001	38,7778	27,7800	6,0000	98,0000	0,2341
AREA_BUILDS_	7119,8889	3490,7779	2529,0000	14189,0000	0,5977
BUILDS_2001	79,2222	54,3789	6,0000	159,0000	0,9684



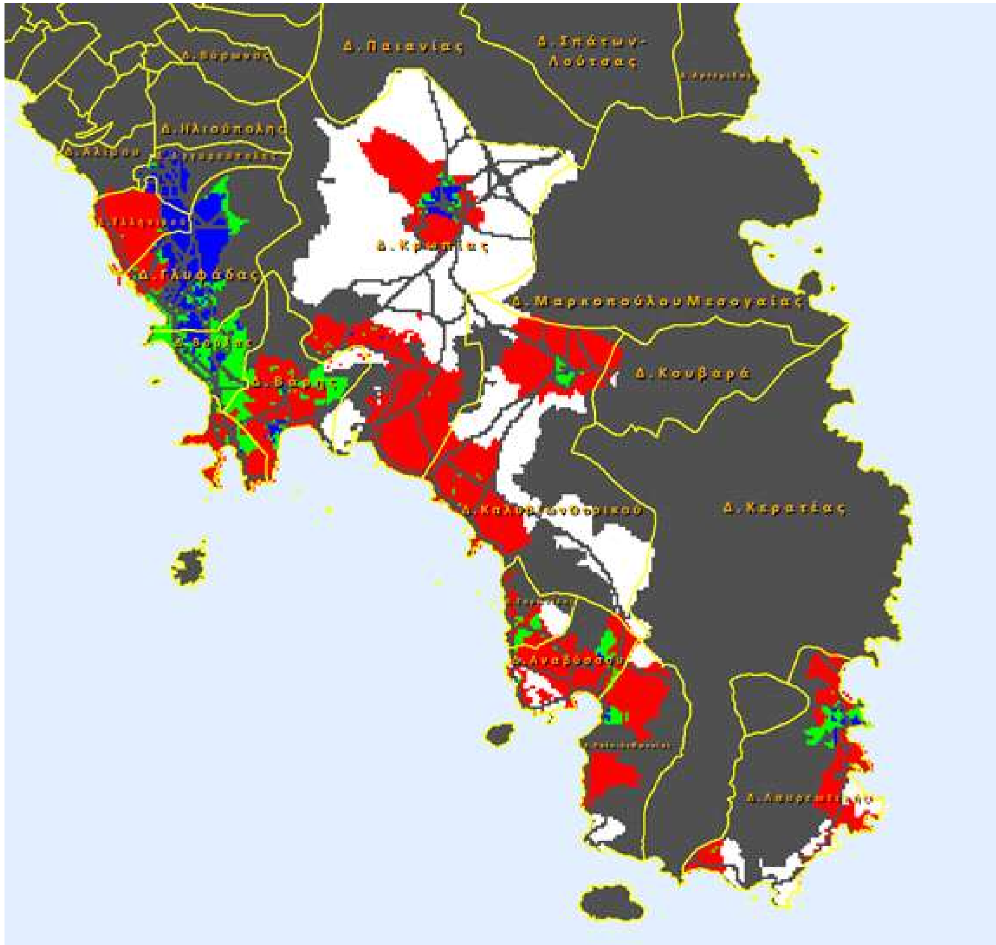
Classification is based on these properties.

4. Define the profile of a class
5. Repeat 4 for all of the classes of the studied area.

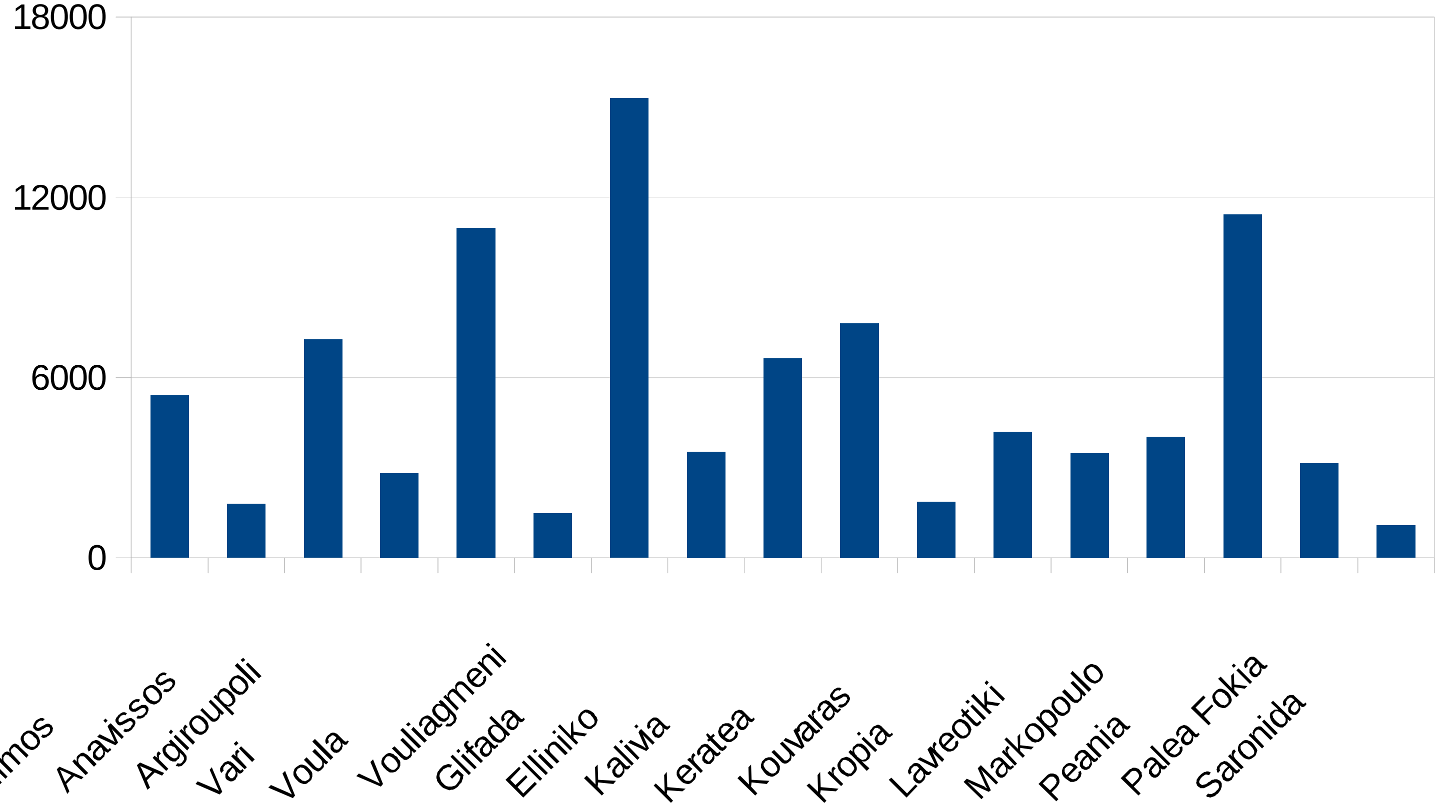


Statistical characteristics of studied area and profile of classes.

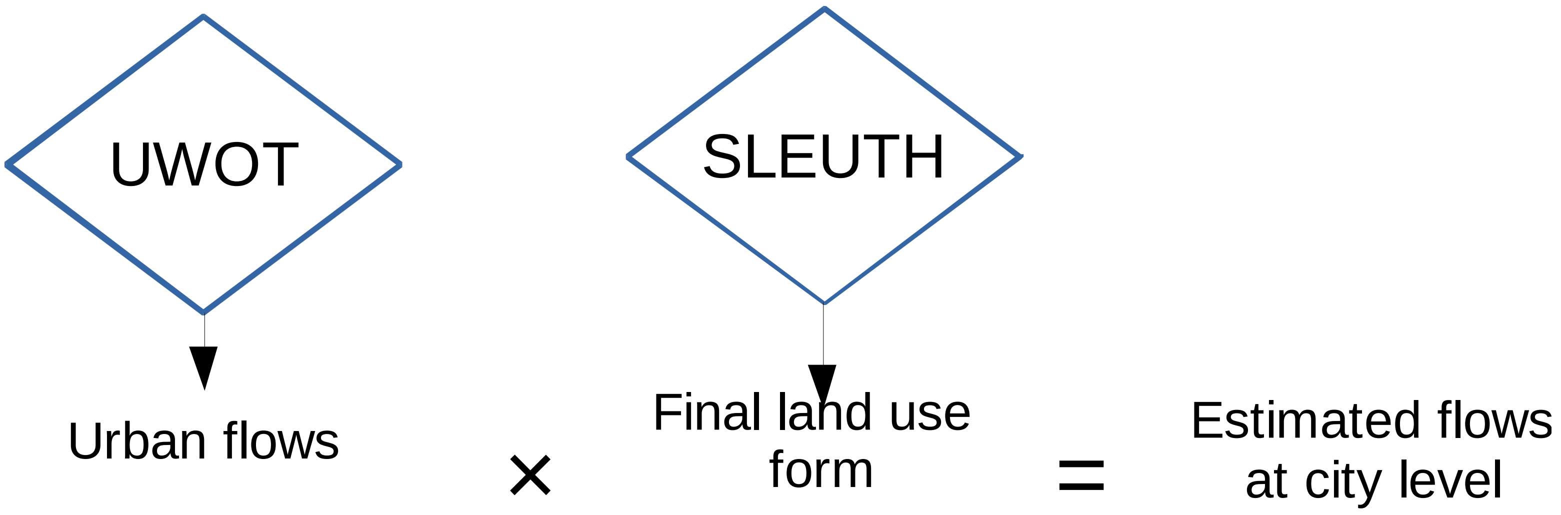
Spatial representation of the classification (initial urbanization).



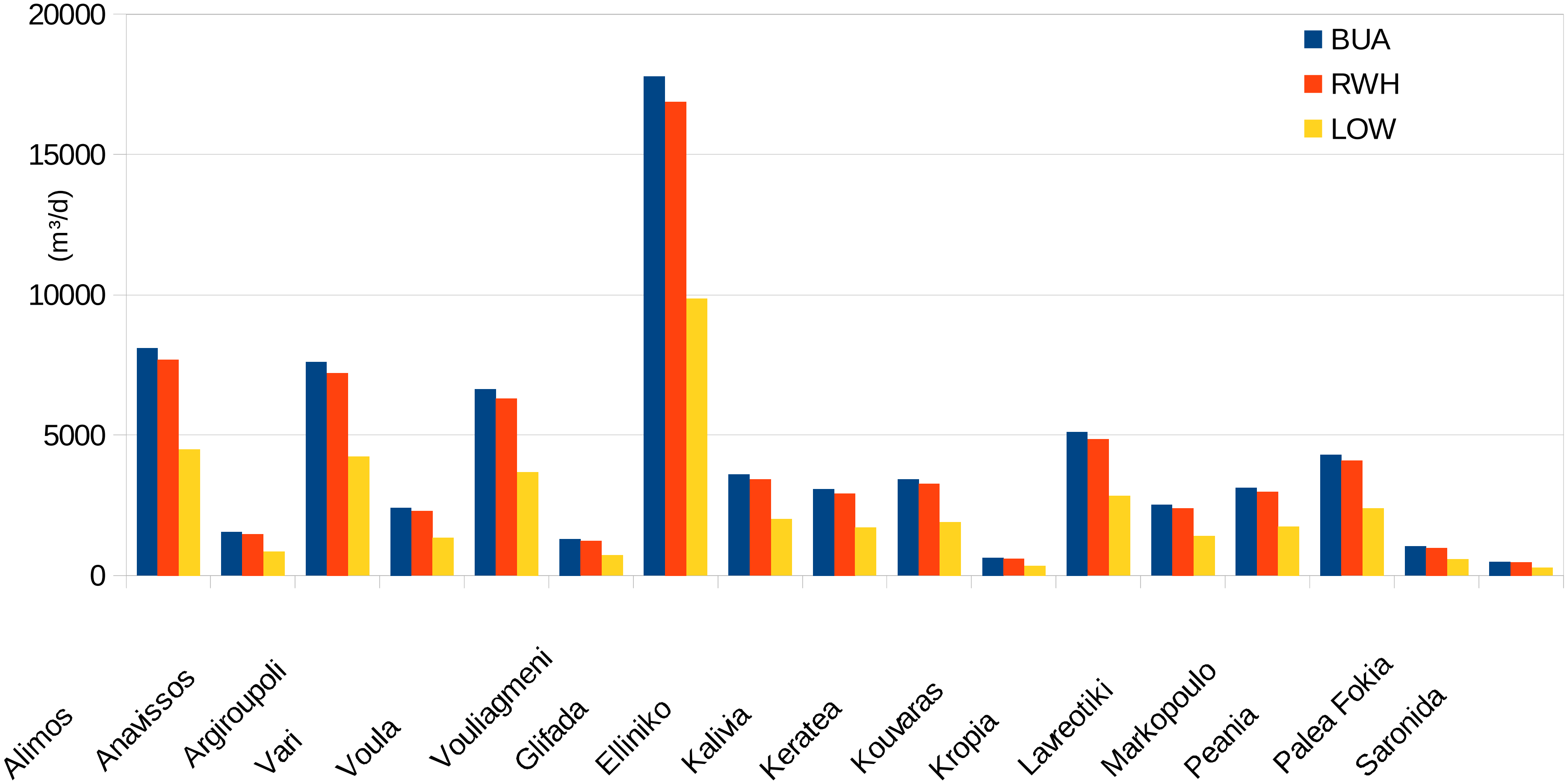
Estimated population influx over a period of 30 years.



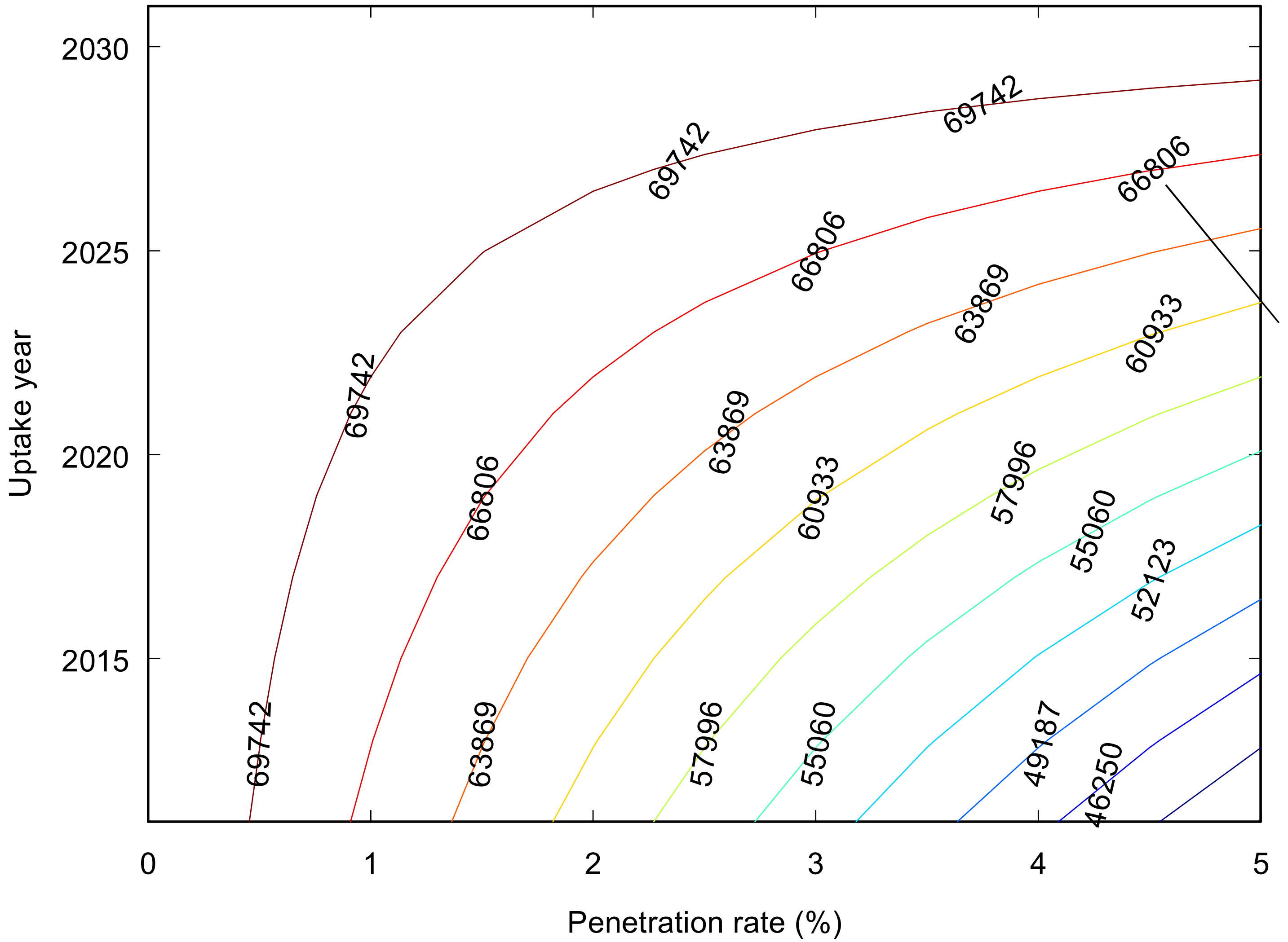
The representative household of each class is simulated with UWOT assuming BUA, LOW and RWH (number of classes × number of technologies). The results are multiplied by the number of households per class, as it is estimated by SLEUTH.



Water demand per municipality after 30 years if 100% uptake (both new and existing households).



When – how fast – how much?



Water demand (m^3/d) after 30 years.

In this study an urban water cycle model (UWOT) was coupled with a land use model (SLEUTH) to estimate the impact of urban expansion in an area in North Attica, Greece. The coupling of these models allowed preparing a nomograph that could facilitate the decision making concerning the intervention time or the required penetration rate given the system capacity.

ACKNWOLEDGMENT

This research has been co-financed by the European Union (European Social Fund– ESF) and Greek national funds through the Operational Program "Education and Lifelong Learning" of the National Strategic Reference Framework (NSRF) - Research Funding Program: THALES. Investing in knowledge society through the European Social Fund.

[1] DCLG, The Code for Sustainable Homes, The Water Efficiency Calculator for new dwellings, 2009.

[2] G. Mitchell, Aquacycle – a daily urban water balance model, CRC, 2005.

[3] Project Gigalopolis (2015) URL: http://www.ncgia.ucsb.edu/projects/gig/ (accessed 12/01/2015).