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**

<table>
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<tr>
<th>Litres per minute (a)</th>
<th>Number of fittings present (b)</th>
<th>Quantity using greywater (c)</th>
<th>Greywater supply (d) = (a) x (c)</th>
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Total fittings consumption = Sum of (b)  
Total greywater demand = Sum of (d)  
Average greywater supply from showers (where bath present) = \( \frac{Q}{3} \times 4.37 \)  
Average greywater supply from showers (shower only) = \( \frac{Q}{3} \times 5.60 \)

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.
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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.
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Configuration 1 – low consumption appliances (LOW)
SLEUTH is a CA model that combines terrain mapping and land cover deltatron modelling to simulate urban development [3].
1. Discretize spatially the study area
2. Define the kind of properties
3. Obtain statistical characteristics of studied area

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.

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