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Urban growth leads to reduced water availability

Whatever form it takes, urban growth leads to reduced groundwater availability, according to a new study. The paper highlights the fact that urbanisation is not always sustainable and recommends that planners consider no-growth scenarios for economic development.

Groundwater is water stored underground in rocks and soil and makes up over 97% of the world's freshwater availability. A total of 75% of the European population depends on groundwater for their water supply. It is also an important resource for industry and agriculture.

The study looked at the effects of residential growth on groundwater availability in Monroe County, Michigan, USA. An integrated land-use model was used to simulate different patterns of increasing urbanisation. The landscape used in the model was composed of 33,200 'cells', each representing about 16 acres of agricultural land that could be converted for residential development. There was no agricultural irrigation used in these scenarios, as the researchers were trying to establish the impact of urban growth on groundwater availability.

Three different patterns of urban growth were simulated where residential development was concentrated in either few large clusters, spread over more medium-sized clusters or scattered into many small clusters. The total amount of land converted for residential development was the same in each scenario. Each pattern of urban growth was simulated over 100 and 200 year periods. The rate of urban development over these time periods and the rate of residential water usage included in the model were based on real estimates for Monroe County, Michigan.

In all scenarios, as the population increased so did water deficiency. Scattering the population may provide some temporary relief, compared to larger urban clusters. However, in the long term there were no significant differences in water availability, per household, between the different urban forms. In terms of reducing the total area experiencing water shortages, concentrating development in large clusters was favourable, suggesting that large cities may be more sustainable than smaller neighbourhoods. Overall the simulations indicated that beyond a certain point, urban growth that is dependent on groundwater supply is not sustainable, no matter what form that growth takes.

The researchers suggest that rather than assuming growth, urban planners should consider no growth or reduced growth scenarios for economic development in areas dependent on groundwater. They recommend the use of a similar modelling approach to assess the impact of urbanisation on groundwater availability in specific locations. The same modelling principles can be applied and adapted, based on local data and assumptions. This will allow stakeholders to analyse the relationship between policies and planning decisions, local hydrology and regional groundwater resources.

Source: Zellner, M.L., and Reeves, H. W. (2012) Examining the contradiction in 'sustainable urban growth': an example of groundwater sustainability. *Journal of Environmental Planning and Management.* 55: 545-562. DOI: 10.1080/09640568.2011.614426
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