

## Effects of reduced leakage from the water main on the spring at Otomeyama Park in Shinjuku ward

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Decreasing of spring discharge in Tokyo is a problem since it leads to lost of the place for relaxation and refreshment for the citizens. To date, it has considered that increasing of impervious land cover followed by rain infiltration blocking results in decline of spring discharge. Although declining in a spring discharge in Tokyo was reported by several investigations, the causes of the declining was not quantitatively discussed based on the water budget. In order to estimate the causes, we observed spring discharge at Otomeyama Park in Shinjuku ward for 5-years (2009-2013) and evaluate water budget of the spring by means of tank model analysis. In this evaluation, not only increasing of impervious land cover but also diminish of reduced leakage from the water main are take into consideration.

From stable water isotopes measurement, it is suggested that leakage from the water main recharges the spring. From Detailed Digital Information (10m Grid Land Use), it was determined that land cover/land use of the subject area has remained unchanged since the 1980's so that it does not effect spring discharge. We developed a model that represents discharge from the spring based on the observation. The model was calibrated using data from 2012-2013 and validated using data from 2009-2012. We used the model to simulate the discharge for 1998-2013 and specifically investigated the impacts of impervious land cover fraction and water main leakage on long-term trends in the spring discharge. If we take into account reduced leakage from the water main, then discharge is decreasing over time.

Keywords: spring, Tokyo wards area, impervious land cover fraction, water main leakage, tank model