

# Evaluation of degree of toleration of drought by a social experiment

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## 1. Introduction

In Japan, normal responses in drought periods are restrictions on water intake according to river flow rate or dam reservoir storage percentage from the standpoint of managers, but responses from the perspective of water users considering their tolerance of droughts are rare. Therefore, the author's performed a water stoppage social experiment to survey and analyze drought damage to clarify tolerance of drought in order to more rationally perform drought adjustments including the perspective of the water users in the future.

## 2. Outline of the water stoppage social experiment

The water stoppage social experiment was performed with the cooperation of Hirakata City in Osaka Prefecture. Artificial water stoppages to deliberately prevent water use by 60 households with 153 members were performed for a total of 8 days, with the water stopped for 6 hours for 3 days, 9 hours for 3 days, and 12 hours for 2 days. The water stoppage social experiment was short, so a questionnaire survey based on the premise the drought continued for a long period was carried out.

## 3. Analysis of the results of the survey

The results of the survey were analyzed in order to specify the attributes with high impact on drought tolerance and to abstract attributes of weak tolerance of droughts. This analysis was performed using quantification II type as the statistical method in order to handle data which cannot be quantified, which is the level of tolerance. Tolerance/non-tolerance was set as the objective variable and the attribute as the explanatory variable and a model formula shown as formula (1) was prepared by stoppage time and by restricted period.

$$Y = a_1X_{11} + b_1X_{12} + c_1X_{21} + d_1X_{22} + e_1X_{23} + f_1X_{24} + \dots (1)$$

Y: objective variable (tolerance/non-tolerance)

X<sub>ij</sub>: explanatory variable (each attribute)

X<sub>1j</sub>: sex, X<sub>2j</sub>: family constitution

a<sub>i</sub>, b<sub>i</sub>, c<sub>i</sub> ---: category score (degree of impact on objective variable)

A relational formula was prepared by treating the

objective variable Y as tolerance/non-tolerance, and the explanatory variable X<sub>ij</sub> as monitor attribute, and setting 1 in a case where each corresponds, and 0 in a case where each does not correspond. A simultaneous equation was solved to maximize the correlation ratio, and if the category score obtained was positive it was judged to be a factor working tolerably, and if it was negative, a factor working intolerably. As a result of the analysis, "household with many members" and "household with all members 65 or older" were seen to be factors acting intolerably.

## 4. Drought tolerance level

Next, in order to evaluate the level of tolerance for droughts, water stoppage period and water stoppage hours were organized based on a matrix. In responses to the questionnaire survey, a regression curve on which the percentage of "harsh" and the percentage of "harsh" and "a little harsh" are over 50% was obtained based on the interpolation method, and set as the boundary of each tolerance level. Figure 1 shows the tolerance level curve.

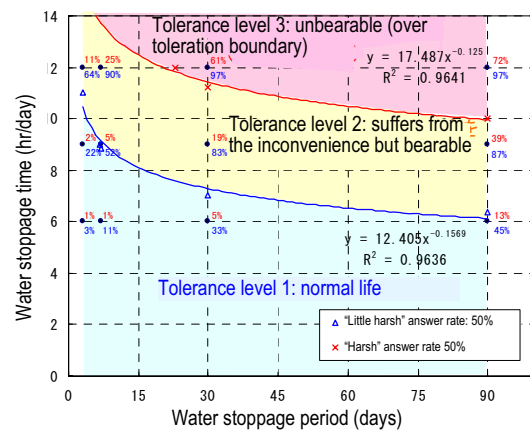


Figure 1. Tolerance Level Curve

## 5. Conclusion

Based on the results of analysis performed in this research, persons requiring protection during a disaster caused by a drought were specified, and tolerance levels for droughts were set. We are counting on the facts learned from this research being the basis for a proposal for a study of a drought adjustment method

including the perspective of water users to be applied when future droughts occur.

<http://www.nilim.go.jp/lab/fdg/index.htm> (Water Management and Dam Division)