



# How do people's perceptions and climatic disaster experiences influence their daily behaviors regarding adaptation to climate change? – A case study among young generations



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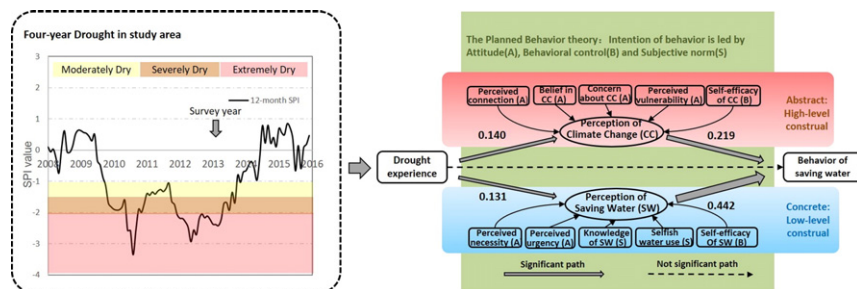
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## HIGHLIGHTS

- Drought experience influences related adaptive behaviors indirectly.
- TPB and CLT theories are applied jointly to analyze adaptive behaviors.
- Concrete construal of perception promotes better drought adaptive behaviors.
- Feasibility may be more important than desirability to adaptive behaviors.

## GRAPHICAL ABSTRACT



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## ABSTRACT

Adaptation is a commonly applied strategy used to address individual behavior changes, in response to climate change. However, in-depth, evidence-based investigations of the relationships among individual perceptions, climatic disaster experiences, and daily behaviors regarding adaptation to climate change remain to be conducted. We obtained survey data from 488 respondents in southwestern China, a region prone to frequent and severe droughts, to assess factors that influence adaptive behaviors and to identify their pathways. We applied Construal Level Theory (CLT) and the Theory of Planned Behavior (TPB) to differentiate between respondents' high-level abstract construals and their low-level concrete construals. We analyzed the influences of these two levels of perception, combined with drought experiences on water-saving behaviors. We developed a structural equation model to estimate the correlation coefficients of the latent and observed variables in the structural process linked to the respondents' adaptive behaviors. The results found that a concrete perception of saving water plays a more significant part than an abstract perception of climate change in prompting specific adaptive behaviors. Improving public perceptions of climate change might increase the desirability of adaptation, whereas improving perceptions of water saving might increase the feasibility of implementing adaptive measures. Experience influenced individual behaviors, but that influence was indirect through its effects on perceptions.

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Abbreviations: CLT, Construal Level Theory; TPB, Theory of Planned Behavior; SEM, Structural Equation Model; CC, Climate Change.

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## 1. Introduction

The urgency of and necessity for global engagement to cope with climate change have been scientifically recognized and widely accepted

by academics, governments, media, and the public (Huq and Toulmin, 2006). The Paris Agreement was ratified on Earth Day 2016, shortly after the United Nations Climate Change Conference concluded in Paris at the end of 2015. The Paris Agreement is an achievement demonstrating that most of the world's countries share a generally common scientific understanding of climate change and recognize the need for a global agreement on climate. The Agreement sets forth that climate change is most likely irreversible, and, thus, requires immediate global efforts and cooperation (UNFCCC, 2015). Moreover, China and the US are regarded as leaders driving the Paris Agreement's fulfillment and climate change mitigation (Bodansky, 2016).

States' behaviors (e.g., changes to energy structures and development plans) and individuals' daily behaviors contribute to climate change adaptation and mitigation (Huq and Toulmin, 2006; Shove, 2010). Individual actions to address climate change should be proactive and performed consistently and daily. Previous studies have suggested that individual perceptions of climate change and people's disaster-related experiences influence their adaptive behaviors (Dillon et al., 2011; Grothmann and Patt, 2005; Silver and Andrey, 2014). Perceptions of climate change could be influenced by experiential factors such as affect, imagery, and values (Leiserowitz, 2005; Leiserowitz, 2006). Affect refers to the good or bad feedback obtained from a specific object; imagery entails mental representations or cognitive processes; and social values determine how individuals interpret the world.

Psychological, sociological, and cultural factors that directly influence individuals' adaptive behaviors should be considered when attempting to understand behaviors (Wolf and Moser, 2011). However, climate change is a complex phenomenon comprising meteorology, psychology, and public policy (Weber and Stern, 2011). It is likely difficult for laypeople to accurately and consistently understand the subject and might lead to a variety of understandings and perceptions. Studies have found that individuals' perceptions of climate change might lead to behavioral changes involving voluntary mitigation (e.g., through awareness and concern) and barriers to change (e.g., through lack of knowledge, fatalism, and distrust) (Adger et al., 2009; Semenza et al., 2008).

In addition, individuals with previous adverse experiences tend to behave differently as those without such experiences toward disasters associated with climate change (Silver and Andrey, 2014). These experiences could be actual disasters such as earthquakes, droughts and storms, or near-miss situations that influence individuals' responses (Dillon et al., 2011). It is believed that disaster victims are likely to be more concerned about climate change than non-victims, because their experiences would influence their perceptions (Whitmarsh, 2008).

Disaster perception and experiences probably play an important part in prompting individuals' adaptations to climate change. However, many of the above-named studies have empirically separated perceptions from experiences (Battaglini et al., 2009; Silver and Andrey, 2014). Questions about how these two factors jointly influence individual decision-making and what their different effects are have rarely been studied. Spence et al. (2011) advanced this line of research using path analysis to assess relationships among experiences, perceptions, and behaviors. They found that experiences of flooding directly increased the extent to which people were prepared to decrease energy use and indirectly increased it through their perceptions of climate change (Spence et al., 2011).

However, there also remain other aspects of individual perception to be examined. Because individuals' thinking might not extend to climate change when they make adaptation-based decisions, abstract perceptions of climate change might not directly influence behaviors. Moreover, perceptions and experiences should be simultaneously analyzed as experiences of previous behaviors and outcomes might influence current perceptions.

In this study, we designed a survey linking drought experiences, perceptions of climate change and water saving, and individuals' actual water-saving behaviors. And this survey was designed to investigate the following questions.

- 1) Besides augmenting public perceptions of climate change, what other mechanisms exist to improve individuals' adaptive behaviors?
- 2) To what extent do experiences of extreme climatic events change adaptation behaviors?

The Construal Level Theory (CLT) was applied to design questionnaire and obtain data that could explain specific behaviors at different construal levels (abstract and concrete). The Theory of Planned Behavior (TPB) was applied to establish relationships between perceptions and behaviors. The study hypothesized that behavioral intentions are driven by favorable or unfavorable attitudes toward particular behaviors, subjective norms (i.e., pressures from influential persons or society), and perceived behavioral control (Ajzen, 1985; Ajzen, 1991). Specific questions concerned actual water-saving behaviors to avoid the "willingness problem," and the respondents' daily behaviors were comprehensively analyzed.

To investigate these questions, a comprehensive statistical analysis was performed using a Structural Equation Model (SEM). It is to quantify the correlations between the latent and observed variables relevant to the process of fostering adaptive behaviors. Based on this study's identification of the mechanisms driving the adaptive behaviors, concrete recommendations are provided to promote adaptive behaviors related to climate change and its impacts. The existing relationships among perceptions, experiences, and behaviors are highlighted to improve societal adaptive capacities, particularly in southwestern China.

## 2. Theory, materials, and methods

### 2.1. Four-year persistent drought in study area

Many popular indices can be used to monitor drought, such as the Palmer Drought Severity Index (PDSI; Palmer, 1965) and the Standardized Precipitation Index (SPI; McKee et al., 1993; McKee et al., 1995). The current study uses the SPI to measure drought because it is a flexible and powerful tool to assess drought severity and the World Meteorological Organization (WMO) recommends it. Moreover, the SPI can assess drought severity across time scales (1, 3, 6, 9, 12, and 24 months). For example, a short-term SPI measures surface water conditions, such as soil moisture and agricultural stress, whereas a long-term SPI measures groundwater conditions, such as long-term water resource changes (Svoboda et al., 2012).

Yunnan Province in southwestern China has recently suffered from drought. This study calculated three-month and 12-month SPIs using National Meteorological Station monthly precipitations in Yuxi (closest to study area) from 1951 to 2015 and assessed drought severity as moderately dry ( $-1$  to  $-1.5$ ), severely dry ( $-1.5$  to  $-2$ ), and extremely dry ( $-2$  or less). Fig. 1 presents a three-month SPI that indicates an extremely dry drought in 2009 that persisted over the following four years until 2013. Meanwhile, the 12-month SPI also evidences an extremely dry condition from 2009 to 2013. It is clear that the people living in the study area experienced a nearly four-year continuous drought, which was a long enough period that individual adaptive behaviors regarding drought and climate change might change.

During the same period, climate change in Yunnan led to slightly decreasing water supplies and water uses (Yunnan provincial bureau of statistics, 2015). Because the residents might have changed their daily behaviors and adopt adaptive measures in the face of the combined effects of climate change, drought, and water shortages, we conducted a survey to specifically explore their behavioral decision-making mechanisms.

### 2.2. CLT and TPB theory

CLT was first proposed by Liberman and Trope (1998), who used it to predict behavior or explain differences in behavioral decisions in the context of psychological distance (Trope and Liberman, 2010). Psychological distance determines whether a construal level is defined as

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