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Terror Management Theory and Urban Water Decisions

Does Mortality Salience Influence Outdoor Residential Water Consumption?

HANNA C. ROSS AND SARAH E. WOLFE

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Terror Management Theory and Urban Water Decisions: Does Mortality Salience Influence Outdoor Residential Water Consumption?

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Abstract: Terror Management Theory (TMT) researchers have demonstrated that existential threats consistently trigger individuals' defensive responses. Two core responses are worldview protection and self-esteem bolstering through "hero projects." We used TMT to investigate whether water consumption intentions could be defensive responses to existential anxiety. To test our hypotheses, we selected a single, common watering practice in urban Canadian neighborhoods: residential lawn watering. Residential lawns have high hero project potential because they are easily evaluated, publicly visible and typically socially accepted and valued. We also accounted for other potential moderating or predictor variables—lawn preference, environmental identity, and self-esteem—to assess whether they influenced mortality awareness effects on lawn watering behavior. Using either a randomly assigned mortality-salience or a control induction survey on a non-representative sample, we measured mortality salience effects on participants' self-reported lawn watering intentions. Our findings revealed new predictive variables and provide municipal practitioners and policy makers with a deeper understanding of the cognitive and social psychological processes underpinning residential consumers' water decisions. Understanding the role of existential anxiety in water use decisions will help municipal water practitioners design novel and implement effective approaches to decrease water demand.

Keywords: Efficiency, Fear, Lawns, Mortality Salience, Terror Management Theory, Urban Water Consumption

Introduction

Canadians over consume their water resources despite efficiency policies and programs designed to reduce demand rates (ECCC 2011). Researchers have identified many barriers to reducing water consumption, especially the challenge of maintaining lower water use patterns over time (Syme, Nancarrow, and Seligman 2000; Fielding et al. 2013; Sauri 2013; Wichelns 2013). Despite decades of vigorous research on the socio-economic and behavioral drivers of residential water consumption (Baumann, Boland, and Haneman 1998; Brooks 2006; Garcia-Valiñas and Martírnez-Espiñeira 2015; Howarth and Butler 2004; Koop, Van Dorssen, and Brouwer 2019; Maas et al. 2017; Makki et al. 2015; de Oliver 1999; Russell and Fielding 2010; Sebri 2014; Vickers 2001), it remains an open question how water authorities can better generate and maintain reduced residential water demand.

We propose that greater attention must be focused on individuals' socio-psychological drivers (Gifford 2008, 2011), including how contemplating one's mortality may influence environmental decisions (Adams 2016; Clayton et al. 2015). To test this, we use Terror Management Theory (TMT)—a robust and replicable social psychology framework that is supported by hundreds of empirical studies over three decades (Solomon, Greenberg, and Pyszczynski 2004, 2015). Unpacking socio-psychological drivers could offer researchers new opportunities to explore how our efforts to repress mortality awareness influences daily water consumption.

Using TMT's theoretical and empirical insights, we investigated whether mortality reminders influence water consumption intentions. To test our hypothesis, we selected a pervasive watering practice: residential lawn watering. Residential lawns have high hero project

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potential because they are publicly visible, easily evaluated and green, and typically socially valued. Yet in temperate and arid areas, turf lawn watering contributes to unsustainable water consumption rates, compromising water availability, stressing urban water and wastewater infrastructure, and jeopardizing aquatic system health (Cook, Hall, and Larson 2012; Robbins 2007). We posit that lawn watering behavior is a useful test case because lawns hold cultural and personal significance to Canadians, which are critical tenets within TMT.

We considered four interrelated elements. First, we reviewed the strengths and limitations of water demand reduction strategies and considered whether it was appropriate to position residential lawns—their maintenance and subsequent water applications—within the TMT framework as "hero projects." Second, we explored whether lawn watering as a behavioral response could be indicative of mortality awareness defenses. Third, we hypothesized and tested whether individuals with strong lawn preferences would increase their intended lawn watering behavior after a mortality prime. Finally, we investigated a premise that individuals who indicated that they had high self-esteem and strong environmental identities would be unaffected by mortality reminders and therefore would not respond to the mortality prime. Using a randomly assigned mortality salience or a control induction survey for a non-representative urban participant group, we measured mortality salience effects on lawn watering intentions. This in situ approach is valued in interdisciplinary and applied environmental behavior research. It also allowed us to test methods with an anticipated population demographic that would be most likely to respond to our survey topic. Research revealed new predictive variables and provides water authorities with a deeper understanding of the cognitive processes underpinning residential water consumption decisions.

Review of Literatures

Water Demand Management

Canadian households use on average 43 percent of the water distributed by municipalities and allocate between 10 and 75 percent of their total water consumption to outdoor uses (Vickers 2001; ECCC 2011). Outdoor water consumption reductions could significantly decrease municipal water demand, alleviate infrastructure costs, and conserve water supplies. Effective and sustained water demand management strategies are essential to reducing outdoor residential water consumption (Brooks 2006).

There are two categories of water demand management strategies. A water authority may enforce involuntary use regulations and/or encourage voluntary conservation measures. The scholarly literature shows that involuntary regulations—for example, changing water price and by-law-driven mandatory use restrictions—tend to have a greater effect on reducing residential water demand, consistently reducing consumption by 10 to 13 percent (Wichman, Taylor, and von Haefen 2016). Involuntary water-demand reduction strategies have limitations (Sauri 2013). High-income residents tend to be the most prolific with their water use but the least responsive to by-laws and price increases. Increasing prices to the level that would effectively curb demand for high-income households is likely impractical as it could place significant financial stress on low-income, typically low-water use households (Asci, Borisova, and Dukes 2017; Dahan and Nisan 2007; Hellberg 2020; Wichelns 2013). Some researchers have found that mandatory restrictions for outdoor water use can have unintended consequences of generating higher weekly water demand (Castledine et al. 2014). These findings are consistent with the environmentally responsible and pro-environmental behavior literature, which has shown that disincentives or punishment do not generate sustained behavioral changes (Asensio and Delmas 2016; Frederiks, Stenner, and Hobman 2015; Rode, Gomez-Baggethun, and Krause 2015).

In contrast, voluntary measures are designed to motivate behavior changes by effectively influencing personal factors such as knowledge, values, beliefs and norms (Fielding et al. 2013;

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Hoque 2014). Voluntary measures tend to achieve residential water demand reductions of only 1 to 5 percent (Baumann, Boland, and Haneman 1998) or an average of 3 percent under drought conditions and across diverse municipalities (Wichman, Taylor, and von Haefen 2016). Yet urban water authorities increasingly use voluntary programs because these approaches have lower enforcement costs, considered to be 'friendlier', and are more adaptable to varied local water contexts, including variable household incomes (Dascher, Kang, and Hustvedt 2014; Gilbertson, Hurlimann, and Dolnicar 2011; Landon, Kyle, and Kaiser 2016). Despite these successes and benefits, these voluntary initiatives are still considered inferior to involuntary regulations (Blumstein and Saylan 2007; Syme, Nancarrow, and Seligman 2000).

The research also shows that residents' water consumption levels tend to return to similar levels when the intervention programs—voluntary or involuntary—invariably end (Campbell, Johnson, and Larson 2004; Fielding et al. 2013; Freire-Gonzalez 2019; Porcher 2014). Interventions that rely exclusively on factual arguments do not consistently change or sustain residents' entrenched, habitual and often unconscious water behaviors (Adams 2016). The empirical evidence for why people consume 'too much' water suggests that there are additional personal or contextual factors at play (Gifford and Nilsson 2014; Hoque 2014; Sauri 2013; Tabernero and Hernandez 2011). Personal factors include, but are not limited to, household income; household size/age composition; knowledge and skills; habits or routines; and values, beliefs and norms. Contextual factors include water pricing; regulatory policies; technology; climatic variations; and dwelling type/ownership (Hoque 2014; Lee and Kim 2015). Each of these factors have their own explanatory limitations; to move beyond these standard explanations, researchers need a greater understanding of the cognitive and psychological processes underpinning water decisions (Russell and Fielding 2010; Wolfe and Brooks 2017). Findings from social psychology offer a complementary explanation for why water demand strategies fail to elicit the sustained change in residents' water use behaviors.

Terror Management Theory Applications in Environment and Water Contexts

Mortality Awareness and Human Behavior

Terror Management Theory is based on cultural anthropologist Ernest Becker's (1973) efforts to articulate the drivers of human behavior (Solomon, Greenberg, and Pyszczynski 1991). Becker (1973) proposed that our unique capacity for mortality awareness creates an existential terror and we mitigate our existential fears by embracing distinct cultural worldviews that provide a sense of identity and values within our socio-cultural context. Culture and worldviews provide appropriate conduct standards and the illusion of 'immortality' for those who successfully live within the cultural norms; guide opportunities to generate positive self-esteem, i.e., the sense that we are valuable contributors within our social milieu; and reinforce our constructed identities through political affiliations or other cultural associations, e.g., religion (Reiss and Jonas 2019). We are highly motivated to maintain our cultural worldviews and sense of self-worth. As a result, we respond with predictable, significant and empirically replicable defenses when our sense of identity and intrinsic values are threatened (Reiss and Jonas 2019; Solomon, Greenberg, and Pyszczynski 2015; Solomon and Thompson 2019).

Empirical support for TMT comes from three primary lines of inquiry (Solomon, Greenberg, and Pyszczynski 2004). First, individuals' high self-esteem reduces their anxiety and physiological arousal in response to a threat. Second, the death-thought accessibility hypothesis has shown that contesting participants' strongly held beliefs makes implicit death-related thoughts surface to consciousness (Schimel et al. 2007). Third, investigations of the mortality salience (MS) hypothesis have shown that mortality reminders generate predictable defensive responses to strengthen one's self-esteem by reinforcing cultural worldviews. Distinct

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defensive processes are activated by both cognitively accessible and inaccessible death reminders (Figure 1).

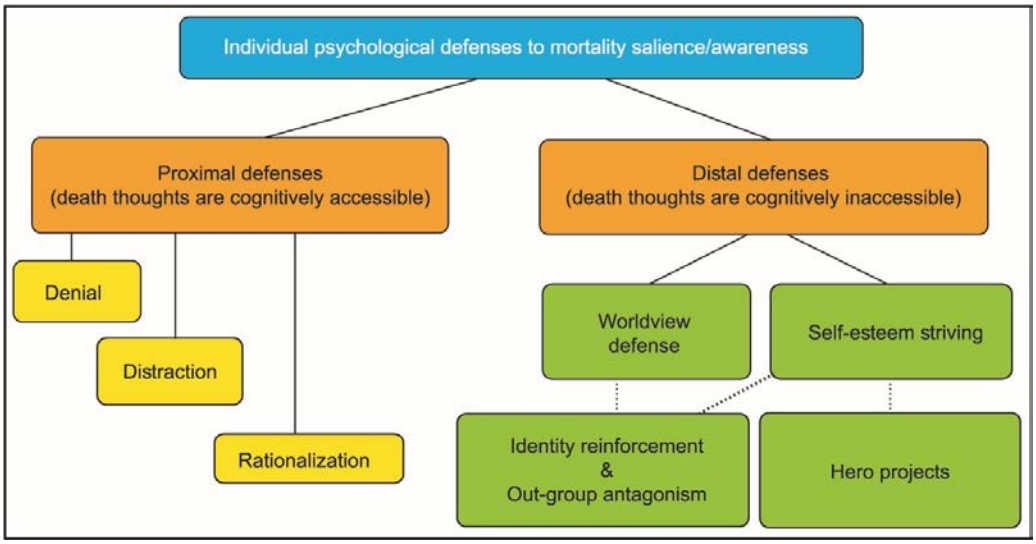

Figure 1: Terror Management Theory's Psychological Defenses to Mortality Salience/Awareness
Source: Wolfe and Tubi 2018

Accessible death thoughts activate proximal defenses: e.g., suppressing death-related thoughts via distraction or rationalization, or pushing the problem of death into the distant future by denying one's vulnerability. Cognitively inaccessible death thoughts activate distal defenses: e.g., maintaining self-esteem and faith in one's culture or worldview. These defenses may include increased antagonism toward, or outright conflict with, other identity groups (Jonas and Fritsche 2013), as well as pursuing culturally validated "hero projects." These hero projects may include anything from philanthropy and fame to parenthood or policies. Hero projects, and the self-esteem that comes with successfully achieving these projects, provides individuals with social recognition and a sense of importance that will—one hopes—extend beyond their biological existence.

What TMT researchers have shown, in hundreds of published empirical studies conducted in more than twenty-five countries, is that MS consistently influences a diverse range of human attitudes and behaviors (Burke, Martens, and Faucher 2010; Cox, Darrell, and Arrowood 2019). These insights are both robust and replicable, offering an intriguing opportunity to gauge whether humanity's poor response to environmental concerns and crises can also be partially explained by MS or mortality awareness. Note that we make a distinction in this text between salience and awareness; we refer to mortality 'awareness' more generally when speaking about triggers that may occur outside of a clinical research context (Sheldon Solomon, email to author, 2017).

Terror Management Defenses and Society-Water Interactions

Research framed by TMT has shown that proximal and distal defenses have significant, sometimes negative, implications for the environment. These studies suggest that death reminders reduce motivations to protect the natural environment (Fritsche and Hafner 2012) and increase exploitation of natural resources (Sheldon and McGregor, 2000); material consumption (Akil, Robert-Demontrond, and Bouille 2018; Kasser and Sheldon 2000; Nepomuceno and Laroche 2016); discomfort with wilderness landscapes (Koole and van den Berg 2005); climate

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change denial; and barriers to climate adaptation and mitigation efforts (Dickinson 2009; Fritsche and Haftner 2012; Haltinner and Sarathchandra 2018; Wolfe and Tubi 2018).

Considering the influence of mortality reminders and how cultural worldviews and self-esteem serve as defenses offers a useful framework to explore the underlying drivers of water use behaviors. Studies on the associative relationship between mortality awareness and water is limited to those related to historic infrastructure, urban flooding, bottled water consumption and water policies (Cote et al. 2017; Cote and Wolfe 2017; Mann and Wolfe 2016; Ross and Wolfe 2015; Wolfe 2017). Other research has focused specifically on water consumption. For example, McCabe et al. (2014) demonstrated the difference between proximal and distal defenses to MS vis-a-vis bottled water while Cote and Wolfe (2017) used TMT indicators to analyze Canadian corporate, pro-bottled water advertising, and public, anti-bottled water campaigns. They estimated that pro-bottled water advertisements had a greater capacity to manage death anxieties because they better support the audiences' self-esteem, provide the audience with opportunities to engage in worldview defense, and symbolically extend the consumers' perceived lifespan.

Our research contributes to this work on TMT and water decision outcomes by examining evidence of mortality reminders and associated defenses in outdoor residential watering behavior. To evaluate MS effects on water use behavior, we selected lawn watering because it possesses three critical TMT components:

- a cultural norm or social dimension;
- the opportunity to boost one's self-esteem; and
- the promise of symbolic immortality achieved through a hero project.

Below, we describe how the cultural value associated with the iconic residential lawn and subsequent lawn watering applications satisfy the TMT criteria.

Green Lawns within the Canadian Cultural Worldview

European immigrants searching for economic opportunity flocked to North America between the 1800s and 1930s. These immigrants carried grass species and livestock to re-create the familiar landscapes they left behind (Jenkins 1994). Those who successfully harnessed North America's economic potential began to signal their new wealth status with expansive lawns (Steinberg 2006).

Unlike the temperate climates of the British and European immigrants' homes, North America's climate was not universally favorable for lawns. To sustain the expansive wealth-signaling manicured lawns, sprinklers, fertilizers, pesticides, mowers and manual labor were required (Jenkins 1994). These time intensive and costly inputs made lawns inaccessible for the working class who had limited disposable income, leisure time, or land access. Even if the urban working poor had access to small plots, these would be cultivated as small-scale food gardens to ensure greater household food security rather than lawns (Jenkins 1994). After World War II, when road infrastructure and "suburbia" boomed, the working class began to move out of the urban core into new residential developments (Steinberg 2006). They left behind the crowded urban streetscapes for suburbia's cultural symbol of the American Dream: the green lawn (Steinberg 2006).

Residential "lawnscapes" became the norm; Statistics Canada has estimated that up to 83 percent of Canadian households have lawns. Lawn maintenance—including watering inputs—is a frequent and often expensive chore (Statistics Canada 2006). While lawns' benefits are widely recognized, including improved residents' health, reducing urban noise, enhancing ecosystem services, preventing soil erosion, flood control, carbon sequestration, and urban heat island mitigation (Larson et al. 2009), the concern is that less than environmentally friendly lawn care practices effectively nullify the benefits (Hostetler and Main 2010).

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Pesticides and fertilizers jeopardize aquatic ecosystems and water quality. Grassy, mono-cropped lawns also alter the socio-ecological systems by replacing forested areas and native grasslands, reducing biodiversity, and fragmenting forest corridors. Compared to the native landscapes, residential lawns are less effective at reducing run off, moderating the urban heat island effect and mitigating carbon sequestration (Guhathakurta and Gober 2010). Municipal and national surveys show that lawn and garden watering increase residential water consumption rates by over 50 percent. This vast increase stresses local water supplies, water distribution infrastructure (Statistics Canada 2006), and can prematurely trigger infrastructure capacity expansions to address this peak load problem.

Water authorities encourage residents to consider alternatives to lawns or not provide additional water during the dry, summer months. Canadian households allocate anywhere between 10 and 75 percent of their total monthly water consumption to outdoor use (Vickers 2001). Therefore, lowering outdoor water consumption rates could significantly reduce overall residential water demand. However, voluntary and involuntary measures are consistently shown to be ineffective at motivating sustained behavioral changes (Martini and Nelson 2015); people persistently water their lawns throughout periods of severe drought and mandatory water restrictions, frustrating water authorities and puzzling researchers (Yabiku, Casagrande, and Farley-Metzger 2008).

To explain these contradictory behaviors, researchers have identified several lawn care predictors: socioeconomic status; home ownership and property value; knowledge and perceptions of lawns and environmental consequences; and sociocultural pressures (Brehm, Pasko, and Eisenhauer 2013; Carrico, Fraser, and Bazuin 2013; Larsen and Harlan 2006; Martini and Nelson 2015). These lawn-specific findings align with the research on drivers of water consumption and environmental behavior research (Howarth and Butler 2004; Larson et al. 2009; de Oliver 1999). This existing research offers a glimpse into why residents continuously, and sometimes gratuitously, water their lawns. But the insignificant and temporary reductions in outdoor water demand suggest we need to know more about why residents continue to water despite multiple interventions to change their consumption behavior. We propose that recognizing lawns as terror managing hero projects could be another predictor variable to explain excessive water consumption.

Residential Lawns as Hero Projects

People use culturally-meaningful projects to achieve symbolic immortality or hero projects: achieving symbolic immortality will extend our memory beyond our time-limited biophysical existence, see for example, Egypt's Giza pyramids or France's Versailles gardens. According to the MS hypothesis, when we live within our worldview's cultural expectations, we bolster our self-esteem, allowing us to transcend death by feeling like our lives have purpose. Every culture has their own hero projects, but some projects may also contribute to environmental problems.

Knowing the historical and cultural significance underpinning current landscape preferences, e.g., lawns, can help us understand why people strive to achieve and maintain those landscapes (Brooks and Francis 2019). Different landscapes throughout history have provided shaped and diversified worldviews or expectations of what was "good" (Milfont and Schultz 2016). Some landscapes have such a profound influence within our cultures that they can be classified as cultural landscapes,[2] existing within our collective identity and society. This status can sometimes result in discounting cultural landscapes' potential socio-ecological impacts. Desire to be part of a socially-valued landscape overrides one's desire to be embedded within a

[2] Defined by the World Heritage Convention (n.d.), cultural landscapes are "cultivated terraces on lofty mountains, gardens, sacred places ... [that] testify to the creative genius, social development and the imaginative and spiritual vitality of humanity. They are part of our collective identity."

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healthy, resilient, and "natural" landscape. Intertwined in Canada's history and culture, residential lawns are an example of a modern cultural landscape and ideal candidates for terror managing 'hero projects' (Ignatieva et al. 2015).

In the Canadian cultural worldview, lawns have emerged as desirable success symbols and hence possess a key hero project characteristic. The opportunity for individuals to work toward something bigger than themselves that is socially sanctioned or publicly recognized and valued. From a TMT perspective, lawns are not just lawns; rather they are an example of a persistent hero project sustained by our broader cultural worldviews (Carrico, Fraser, and Bazuin 2013; Larsen and Harlan 2006; Robbins 2007). A lush, green lawn ensures that one's cultural expectations are met, and positive self-esteem—by meeting those expectations—is reinforced. Water applications will often ensure that lawns are soft, luxurious, and green, not dry, patchy, and browned. When residents are asked to refrain from aspirational lawn watering, the authorities are actually asking them to stop a project that provides core psychological fulfillment within socially-valued, cultural expectations.

From this perspective, residents' resistance to imposed water constraints makes more sense (Addo, Thoms, and Parsons 2018). When our symbolic immortality projects are threatened, our existential and psychological security is also implicitly threatened. For some individuals, protecting symbolic manifestations may be of more psychological importance than changing behaviors to mitigate negative environmental consequences. This largely unconscious reaction could help explain peoples' supposedly 'non-rational' behavior tendencies (Dickinson 2009). Individuals may water their lawns because the psychological security achieved from having and maintaining a green lawn outweighs the knowledge of the water costs and associated environmental consequences. If mortality awareness defenses are a variable of water behavior choices, then water authorities seeking to maximize their water efficiency efforts need to consider this possibility. In the section below, we explain our methodology for testing the possible influence of mortality reminders on a water-associated hero project.

Methodology

Rationale

Our objective was to assess whether mortality salience (MS) influenced participants' water intentions using two interrelated hypotheses. The first hypothesis was that MS primes would increase intended residential lawn watering for participants with strong lawn preferences. Cultural worldviews determine what we find to be meaningful and hence dictate what actions we should take to consistently reinforce our self-esteem. Since lawns are valued landscapes within the Canadian cultural worldview, they are projects that allow us to achieve a higher self-worth by meeting society's expectations. Lawn watering serves as a self-esteem generating activity for residents who strive to actively maintain their lawns and live up to cultural expectations (Solomon, Greenberg, and Pyszczynski 2015). To identify who had high hero project potential, individuals with strong lawn preferences were identified.

The second hypothesis was that high self-esteem and strong environmental identities may reduce MS influence and hence result in no MS effect on watering intentions. The literature indicates that terror managing defense systems, such as self-esteem and cultural worldviews, work in tandem to suppress mortality awareness so we can function without being paralyzed by fear. But high self-esteem individuals are less susceptible to MS effects: they feel less compelled to bolster their self-esteem by living up to or defending their worldviews because they are already comfortable with their self-worth (Abeyta, Juhl, and Routledge 2014; Pyszczynski et al. 2004). Like high self-esteem, strong environmental identities can also reduce MS influence when assessing environmental behaviors (Fritsche and Hafner 2012; Vess and Arndt 2008). Because cultural worldviews guide the actions people will undertake, mortality reminders could trigger individuals with strong environmental identities to abstain from

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increasing their lawn watering—despite strong lawn preferences—because they have the opportunity to boost self-esteem by taking alternative actions that correspond with and reinforce their pre-existing pro-environmental identities (Fritsche et al. 2010; Selimbegovic et al. 2016; Vess and Arndt 2008). Therefore, given the buffering potential of high self-esteem and strong environmental identities on MS effects and lawn watering behavior, we included these variables in our data collection and analysis.

Methods

Questionnaire Structure

We designed and used a questionnaire packet[3] to identify MS effects on intended lawn watering behavior. Questionnaires are a standard method in TMT studies to determine mortality salience effects (Burke, Martens, and Faucher 2010). Following the typical MS experiment structure, our questionnaire packet had two versions: six identical sections with one version containing either the salience induction or control (Section Two below).

Section One–Personality Inventories: Participants' first task was to complete two filler exercises that resembled personality scales. This section ensured participants did not feel obligated to provide answers they felt the researcher wanted. A third exercise—The Rosenberg (1965) Global Self-Esteem scale (RGSES)—was also completed because it is the preferred measure for self-esteem in TMT research (Solomon, Greenberg, and Pyszczynski 2015). The RGSES consists of ten questions with a four-point Likert Scale that ranges from 1-Strongly Disagree to 4-Strongly Agree (Rosenblatt et al. 1989). This scale was used to account for the potential moderating effects of each participant's self-esteem.

Section Two–Salience Induction: TMT defenses emerge in behaviors when people are reminded about their mortality. Used in approximately 80 percent of studies, MS was induced using the Mortality Attitudes Personality Survey (Burke, Martens, and Faucher 2010). This includes two short-answer questions that ask participants two questions: first, "Please describe the emotions that the thought of your own death arouse in you"; and second, "Write down as specifically as you can, what you think will happen to you physically when you die." The control induction asked similarly phrased questions about dental pain.

Section Three–Affect and Delay Task: Distal defenses (see Figure 1) are activated when death thoughts are unconscious but highly accessible as they may be after salience induction tasks. To suppress participants' death thoughts into unconsciousness, a delay task of approximately two to six minutes is necessary after the MS induction. Studies with two or more delay tasks have stronger distal defenses than those with a single delay task (Steinman and Updegraff 2015). We used two delay tasks of approximately four minutes each to complete.

The first delay task was the Positive and Negative Affective Schedule-X (PANAS-X), a widely-used delay task in TMT research (Watson and Clark 1994). The PANAS-X was used to evaluate the participant's current mood by measuring affect—what an individual is momentarily feeling when exposed to positive or negative stimuli—immediately following the induction. The second standard TMT delay task is a literary preference exercise with one novel passage followed by two neutral questions. TMT studies use neutral but descriptive literary passages without death reminders to direct the participant's focal attention towards the passage rather than the MS induction questions (Steinman and Updegraff 2015).

Section Four–Lawn Preference and Intended Lawn Watering Behavior: Participants' lawn valuation will influence how or if they distally defend after an MS induction. First, we used eleven Likert (1-strongly disagree to 5-strongly agree) questions and one multiple choice question with four picture options displaying different yard-types to determine participants' lawn preferences. Following, we had nine additional Likert questions to measure their intended

[3] The questionnaire packet can be requested via the corresponding author.

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lawn watering behavior and three of these questions involved photo-scenarios that inquired about intended lawn watering practices based on lawn appearances.

Section Five–Demographic Information: As standard practice in TMT studies, eight demographic questions were gathered for any potential within-study moderators or variables that could affect the relationship between MS and intended lawn watering behavior (Burke, Martens, and Faucher 2010).

Section Six–Environmental Identity Scale: The final section included the Environmental Identity (EID) scale, which consisted of twenty-four questions (e.g., engaging in environmental behaviors is important to me) answered with a five-point Likert scale (1-strongly disagree to 5-strongly agree). The EID was used to determine whether the natural environment was important to the participants and influenced their self-identity (Clayton and Opotow 2003). Accounting for EID is important because environmental identities could reveal how participants direct their self-esteem striving efforts (Fritsche and Hafner 2012). If a participant had a strong-environmental identity, i.e., they believed the environment was important to them and who they are, they may choose pro-environment behaviors—even with strong lawn preferences—when primed with MS. These individuals may then choose to use less water because they know it benefits the environment and will receive self-esteem validation as a result. In contrast, individuals with low-environmental identities may continue to water their lawns as they do not have an alternative to boost self-esteem given the context of this study.

Data Collection Procedure

Our case was a medium-sized Ontario region that was unnamed as requested by the municipal administration and as part of our collaboration agreement. Single-detached homes are over 50 percent of the household types in the region, and the population growth rate averaged 1.6 percent per year over the past fifteen years; this growth is projected to continue. Despite the local humid continental climate, water demand increases by up to 50 percent during the summer months, effectively stressing water supplies and infrastructure.

In April 2016, and in collaboration with the municipal administration, an email notified municipal staff of the data collection within their building and information posters were placed in high traffic areas. Recruitment communications indicated that participation was not mandatory but that there was a $5 CAD coffee card incentive provided for survey completion. After five days, fifty-five staff and city residents volunteered to complete a questionnaire packet. Other MS studies have had sample ranges between 17 to 343 participants, with an average of 87 participants. After verbally confirming that potential participants had a residential lawn, they were randomly assigned one of the two questionnaire packets: mortality salience induction (n = 28) or control salience induction (n = 27). The different packets were alternated in distribution and distinguishable only to the researcher by a colored top page. Since the experiment was dependent on participants' unconscious awareness of their personal mortality, participants were not told the questionnaire's true purpose. Instead, participants were told that we were investigating the relationship between personality attributes, lawn preferences and lawn watering attitudes.

Both verbal and written instructions were given to ensure that the participants were exposed to the induction and answered the sections in order. The packets were completed in a quiet room to enhance response integrity, with no more than six participants in the room at a time to minimize distraction, promote anonymity, and ensure participants could finish the questionnaire in a single sitting. Participants took an average of twenty minutes to finish and then they were individually debriefed about the study's true purpose.

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Results and Discussion

Of the fifty-five questionnaire packets distributed, fifty-five were completed; our study was within the appropriate TMT sample range for an empirical study (Burke, Martens, and Faucher 2010). The majority (87%) of our participants were 30 years or older and primarily female (69%). There is debate whether gender influences mortality salience effects (Burke, Martens, and Faucher 2010) and water consumption behavior: for example, Adams (2016) found that males conserved more household water than females, while Dalen and Halvorsen (2011) found more nuanced results. This gender variable was beyond the scope of our study, but this data should be considered as valuable and worthy future research. Our participants were also relatively wealthy by Canadian standards: 51 percent reported an income between $100,000 and $150,000 CAD per year, while 25 percent reported income of between $50,000 ad $99,000 CAD per year. While we did not use these demographic indicators in our analysis, the residential water efficiency literature is inconclusive on whether socio-economic status will or will not predict water savings behaviors (Adams 2016; de Oliver 1999). What both the Adams (2016) and Dalen and Halvorsen (2011) research found was that peoples' sense of agency—whether they identified as agents who could make positive environmental changes—was thus far the most reliable indicator of water savings behavior.

The complete questionnaires were coded and analyzed in IBM SPSS Statistics. Raw data was coded using reverse coding of any negative valence items: the numerical scores for negative valence items in Likert scales run in the opposite direction than the positive valence items. These revised scores were then entered into the SPSS program. Next, scores were summed for each of our four scales: lawn watering behavior; lawn preference; environmental identity; and global self-esteem. The dependent variable—lawn watering behavior—was left as a summed score while all other variables were assigned categories e.g., weak, moderate, strong, or low and high.

Questionnaire Internal Reliability Results

Prior to testing for MS effects, internal reliability values were calculated for each of the six sub-sections within the questionnaire package. An alpha value was considered acceptable when $\alpha > 0.60$ (George and Mallery 2003). After SPSS coding, internal reliability was calculated, and the results are summarized below (Table 1).

Table 1: Internal Reliability for Each Sub-Section

Sub-section	Cronbach's α
Intended Lawn Watering Behavior	0.680
Lawn Preference	0.846
Environmental Identity	0.919
Global Self-esteem	0.856
PANAS-X	
Positive Affect	0.936
Negative Affect	0.934

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All five sub-sections had an internal reliability greater than 0.60, indicating that participants answered questions of similar constructs consistently within each sub-section.

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Lawn Preference Predicting Intended Lawn-Watering Behavior

To assess the influence of lawn preference as a predictor for intended lawn watering behavior, we used an ordinal regression model. The results showed that individuals with weak and moderate lawn preferences had statistically significant lower lawn watering intentions compared to those with a strong lawn preference (Table 2).

Table 2: Ordinal Logistic Regression for Lawn Preference Affect

Subsection Categories	**B**	**Exp (B)**	**95% Wald Confidence Interval for Exp (B)**		**Hypothesis Test**		
			Lower	Upper	Wald Chi-Square	*df*	*p*
Lawn Preference							
Weak	-3.081	.046	.009	.244	13.071	1	.000
Moderate	-1.661	.190	.049	.737	5.762	1	.016
Strong	0[a]	1	.	.	.	.	.
Moderate	1.444	4.237	1.128	15.915	4.572	1	.033
Weak	0[a]	1	.	.	.	.	.
Dependent Variable: Intended Lawn Watering Behavior a. Set to zero because this parameter is redundant							

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However, comparing across moderate and weak lawn preferences showed that individuals with moderate lawn preferences had a statistically significant higher effect on intended lawn watering behavior than those with weak lawn preferences. These findings are consistent with existing lawn preference research: individuals with lower lawn preferences are less likely to water their lawns than those with high lawn preferences (Hayden et al. 2015; Larsen and Harlan 2006). However, these statistical tests did not reveal any differences between lawn preference categories and the MS or control conditions.

Mortality Salience Effects

Mortality Salience Induction Effect Measured via the PANAS-X Scale

After participants completed the mortality salience (MS) or control prime in the questionnaire package, they were given two delay tasks—PANAS-X scale and literary preference exercise—to shift any death thoughts out of their focal awareness. The PANAS-X scale also served a second purpose: it tested whether the MS prime altered participants' affect i.e., conscious mood. One-way ANOVAs—MS vs. dental pain control—on the PANAS-X subscales were computed to examine whether the MS prime altered participants' affect (Tables 3 and 4).

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Table 3: ANOVA for Positive and Negative Affect

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
Positive Affect					
Between Groups	0.240	1	0.240	.604	.441
Within Groups	21.089	53	.0398		
Total	21.330	54			
Negative Affect					
Between Groups	.007	1	.007	.044	.835
Within Groups	8.878	53	.168		
Total	8.885	54			

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Table 4: ANOVA Descriptive Statistics for Positive and Negative Affect

Source	*n*	*M*	*SD*
Positive Affect			
MS	28	2.7832	.56133
Control	27	2.9153	.69565
Total	55	2.8481	.62848
Negative Affect			
MS	28	1.3750	.27507
Control	27	1.3519	.51273
Total	55	1.3636	.40564

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We found no significant effects for either positive affect F (1, 53) = .604, p = .441 (M = 2.7832, SD = .56133 vs. M = 2.9153, SD = .69565 for MS and control conditions, respectively), or negative affect, F (1, 53) = .044, p = .835 (M = 1.3750, SD = .27507 vs M = 1.3519, SD = .51273 for MS vs control). Our results indicate that MS and control primes did not affect participants' conscious moods, which is consistent with established TMT research and an essential outcome for subsequently measuring distal defenses.

Mortality Salience Effects on Intended Lawn Watering Behavior

A cumulative odds ordinal logistic regression with proportional odds was performed to determine the effect of MS on intended lawn watering behavior (Table 5).

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Table 5: Ordinal Logistic Regression for Mortality Salience Affect

Subsection Categories	B	Exp (B)	95% Wald Confidence Interval for Exp (B)		Hypothesis Test		
			Lower	Upper	Wald Chi-Square	*df*	*p*
MS	-.162	.850	.332	2.177	.114	1	.735
Control	0[a]	1	.	.	.	.	.
Dependent Variable: Intended Lawn Watering Behavior a. Set to zero because this parameter is redundant							

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For this analysis, the deviance goodness-of-fit test indicated that the model was a good fit to the observed data, χ^2 (330) = 138.268, p = 1.000. We did not find that MS increased stated intentions for participants to water their lawn. The odds of the MS condition affecting intended lawn watering behavior was 0.85 (95% CI, .332 to 2.177) times lower than the control condition (dental pain), with a non-statistically significant effect of χ^2 (1) = .114, p = .735. That is, participants made to contemplate their mortality were more likely to have lower intended lawn watering behavior. This non-significant result is most likely the result of variations within the sample population.

Building upon the findings from the ordinal logistic regression model for lawn preference affect (Table 2 above) and mortality salience affect (Table 5 above), the Mann-Whitney U test was subsequently used to confirm whether the MS or control conditions generated differences in lawn watering behavior across the three lawn preference categories (Table 6).

Table 6: Mann-Whitney U results for Lawn Preference Affect

Subsection Categories	Condition	Observations	Rank-Sum	*U*	*z*	*p*
Lawn Preference						
Weak	MS	5	27.50	12.50	.000	1.000
	Control	5	27.50			
Moderate	MS	19	331.50	141.50	-.035	.973
	Control	15	263.50			
Strong	MS	4	33.50	4.50	-1.804	.073
	Control	7	32.50			

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The Mann-Whitney U test results, combined with the ordinal logistic regression for lawn preference affect results (Table 2), confirms that lawn preference influences lawn watering behavior. As expected, the Mann-Whitney U test results, combined with the ordinal logistic regression for MS affect (Table 5 above), confirmed that MS did not appear to arouse distal defenses responses for individuals with variable lawn preferences.

This finding contradicted our first hypothesis that MS primes would increase intended residential lawn watering for those with strong lawn preferences. In other words, the lack of a statistically significant effect measured in both the ordinal logistic regression for MS affect and the Mann-Whitney U test offers a preliminary finding that death anxiety may not play a role in influencing lawn watering behavior—a hero project defense—even when accounting for different lawn preferences. In response to this finding, we propose two possible explanations for why no MS effects were observed even when integrating different lawn preferences.

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First, our geographic scope was limited to a single southern Ontario community. On average, precipitation levels are highest during the summer months in southern Ontario due to the local humid continental climate (Baldwin, Desloges, and Band 2000). It may be that participants, despite their lawn preferences, simply assume that they can achieve a green lawn without significantly adjusting their existing lawn watering behaviors. However, we suspect that areas where drought is more seasonally prevalent may engender different water consumption behaviors in response to MS triggers. This raises an important question: do lawn watering behaviors change, following an MS induction, in water scarce regions where non-xeriscaped lawns are more susceptible to visible browning? Answering this question will be critical for water managers as uncertainty surrounding water availability increases due to climate change, aging urban infrastructure and increased water demand.

This question may be even more urgent as water scarcity is understood as a "water-specific" mortality trigger, possibly activating both proximal and distal defenses (Wolfe and Brooks 2017). Researchers should study how watering behaviors—including climate change adaptation and mitigation responses—change across different geographic contexts, especially if the hydrological conditions intensify as a potential mortality awareness trigger (Wolfe and Tubi 2018). If water scarcity triggers MS and lawns are symbolic immortality projects, then green lawns could become vital to protect despite the environmental impacts. Such research would improve our understanding for how people respond in times of scarcity compared to times when precipitation is abundant.

Second, in previous studies, MS primes paired with delay tasks have triggered distal defenses that resulted in intended actions important to one's self-worth despite these behaviors having negative personal or environmental consequences. Beyond variations within the sample population, we question why MS did not affect intended lawn watering behavior in southern Ontario. It is possible that lawns are not symbolic immortality projects. If this were true, then following the MS prime and delay task, participants would not have adjusted their lawn watering behavior if lawns did not offer a sense of existential security. In this scenario, there would have been no identifiable differences between the MS and control. Given the null results, this appears to be true and water managers' efforts to motivate water efficiency behaviors would be free to continue using mortality reminders in education campaigns.

However, if lawns are symbolic immortality projects, then there must be other factors within our psyche's terror managing system that can override MS effects. TMT states that self-esteem influences whether or not someone will respond to mortality reminders, whereas cultural worldviews explain how they will respond. We anticipated that other possible variables—environmental identity and self-esteem—could alter how participants respond to lawn watering questions, or potentially eliminate one's need to defend against MS. We accounted for these variables as discussed below.

Mortality Salience and Environmental Identity Results

One's environmental identity—defined as whether nature is considered relevant to the self—can be a potential moderator and possibly buffer MS effects on lawn watering behavior (Clayton and Opotow 2003; Fritsche and Hafner 2012). An individual's self-defined environmental identity can also be a reliable predictor of pro-environmental behavior (Dresner et al. 2015; Truelove et al. 2014). Environment identity was included as a predictor variable in the ordinal logistic regression model.

Consistent with the MS null result in the ordinal regression model in Table 5, calculated p-values show no statistically significant differences between MS and control conditions for all three environmental identity categories: weak, moderate and strong. The only statistically significant effect from the ordinal logistic regression model (Table 7) showed that the odds of

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individuals with a moderate environmental identity had higher levels of lawn watering behavior compared to a strong environmental identity.

Table 7: Ordinal Logistic Regression Environmental Identity Affect

Subsection Categories	**B**	**Exp (B)**	**95% Wald Confidence Interval for Exp (B)**		**Hypothesis Test**		
			Lower	Upper	Wald Chi-Square	*df*	*p*
Environmental Identity							
Weak	1.048	2.852	.214	37.957	.629	1	.428
Moderate	1.958	7.083	2.420	20.730	12.766	1	.000
Strong	0[a]	1	.	.	.	.	.
Moderate	.728	.300	1	.584	2.071	.153	28.078
Weak	0[a]	.	.	.	1	.	
Dependent Variable: Intended Lawn Watering Behavior a. Set to zero because this parameter is redundant							

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Our finding is consistent with research that declares people who value the environment are more likely to participate in pro-environmental behaviors (Dresner et al. 2015; Truelove et al. 2014). Therefore, it would make sense that individuals with a weak environmental identity would also have higher levels of lawn watering behaviors compared to individuals with moderate or strong environmental identities, but there was no statistically significant difference between these variables on lawn watering behavior. This may be the result of our sample population proportions with a weak environmental identity (3.6%).

The ordinal logistic regression compared different environmental identities effect on lawn watering behavior without comparing between the MS and control conditions. To further explore differences between weak, moderate, and strong environmental identities for the MS and control conditions, a Mann-Whitney U test was performed (Table 8).

Table 8: Mann-Whitney U Results for Environmental Identity Affect

Subsection Categories	**Condition**	**Observations**	**Rank-Sum**	***U***	***z***	***p***
Environmental Identity						
Weak	MS	1	1.00	.000	-1.000	1.000
	Control	1	2.00			
Moderate	MS	14	195.00	50.000	-1.180	.259
	Control	10	105.00			
Strong	MS	13	168.00	77.000	-1.187	.249
	Control	16	267.00			

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Consistent with the overall MS affect null result, calculated p-values showed no statistically significant differences between MS and control conditions for all three environmental identity categories on lawn watering behavior. This result supports our second

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hypothesis that strong environmental identities may reduce MS influence and negate effects on watering intentions.

Since distancing oneself from nature or "wilderness" may be an existential anxiety-buffer (Koole and van den Berg 2004, 2005), maintaining a cultivated landscape such as a lawn may be one of participants' distancing strategies. However, the null result in the Mann-Whitney U test for lawn preferences and environmental identity suggests that participants did not activate an existential anxiety-buffer. Instead, the mortality salience prime existential may have been neutralized by participants' pre-existing strong environmental identities.

Fritsche and Hafner (2012, 584) found that if one's self-worth is contingent on a strong environmental identity, then their desire to distance from nature is eliminated: "pro environmental action should be reduced under conditions of threat only if it is designated to protect nature for its intrinsic value but not if it is about savings humans or the self." Therefore, activating distal defenses to distance oneself from nature by actively maintaining a cultivated landscape may not have been required for psychological security, especially for those with strong environmental identities. Given this reasoning, individuals with weak environmental identities should have increased their lawn watering behavior. Since there were a low number of participants (3.6%) with a weak environmental identity our sample population may not have fully captured the weak environmental identity population. As such, we cannot make any conclusions regarding the relationship between MS effects, weak environmental and lawn watering. Future research should be completed to obtain a more accurate measure of MS effects on individuals with weak environmental identities and their lawn watering behavior.

Mortality Salience and Global Self-esteem Results

Global self-esteem was included in the logistic ordinal regression model as a predictor variable. Psychological studies on self-esteem have shown that individuals with high self-esteem, compared to low self-esteem, report increased subjective well-being (Schimmack and Diener 2003). High self-esteem serves as a terror-managing device by diminishing individuals' desire to seek out cultural in-groups' social validation; external validation is less necessary because they already feel that they are worthy individuals. Therefore, high self-esteem can potentially reduce or eliminate individuals' responses to mortality reminders (Harmon-Jones et al. 1997; Schmeichel et al. 2009).

Individuals with low self-esteem tend to respond more defensively to mortality reminders by seeking activities that increase their self-esteem. As displayed in Table 9, the odds of low self-esteem individuals affecting lawn watering behavior is .37 times lower than individuals with high self-esteem, with a non-statistically significant effect, χ^2 (1) = .867, p = .352. As expected, global self-esteem was not a predictor of lawn watering behavior.

Table 9: Ordinal Logistic Regression Global Self-Esteem Affect

Subsection Categories	**B**	**Exp (B)**	**95% Wald Confidence Interval for Exp (B)**		**Hypothesis Test**		
			Lower	Upper	Wald Chi-Square	*df*	*p*
Global Self-esteem							
Low	-.992	.371	.046	2.994	.867	1	.352
High	0[a]	1	.	.	.	.	.
Dependent Variable: Intended Lawn Watering Behavior a. Set to zero because this parameter is redundant							

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Although self-esteem was not a predictor of lawn watering behavior as measured in the ordinal logistic regression, the role of self-esteem within the TMT framework is more important when exploring differences between the mortality salience and control conditions. To further assess the relationship between self-esteem, lawn watering behavior and mortality salience, a Mann-Whitney U test was calculated. The calculated p-values in Table 10 show no statistically significant differences between MS and control conditions for low and high self-esteem.

Table 10: Mann-Whitney U Results for Global Self-Esteem Affect

Subsection Categories	**Condition**	**Observations**	**Rank-Sum**	***U***	***z***	***p***
Global Self-esteem						
Low	MS	2	22.50	2.000	.000	1.000
	Control	1	14.00			
High	MS	26	383.50	336.00	-.037	.971
	Control	26	364.00			

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Consistent with the ordinal logistic regression results, the Mann-Whitney U tests have shown that there are no significant effects between the MS and Control conditions when accounting for different potential predicting variables. Since most of the sample population (95%) had high self-esteem, the lack of significant effects from the Mann-Whitney U test for global self-esteem could be explained by self-esteem acting as a potential moderator – eliminating MS effects. In accordance with other TMT studies that have shown the moderating effects of self-esteem (Harmon-Jones et al. 1997; Schmeichel et al. 2009), this finding offers a possible explanation for why mortality reminders did not trigger defenses within our study.

It also supports the second hypothesis that in addition to environmental identity, self-esteem may reduce MS influence and result in no effect on watering intentions. Since self-esteem can have considerable influence over responses to mortality reminders and acknowledging that a significant portion of the sample population had high self-esteem, we suggest that additional research should determine whether lawn-watering intentions change with low self-esteem individuals under mortality salient conditions.

Conclusions

Terror Management Theory research has repeatedly demonstrated that existential threats trigger individuals' defensive responses to protect the worldviews and bolster their self-esteem through the pursuit of hero projects. In this study, we considered whether lawns exhibited hero project characteristics, and how lawn watering could serve as a mortality salience (MS) defense. We proposed that individuals with strong lawn preferences would increase their intended lawn watering behavior after a mortality prime, and high self-esteem and strong environmental identities may reduce MS influence, resulting in no effect on watering intentions.

This work contributes four important findings. First, and not unexpectedly, stronger lawn preferences and weaker pro-environmental identities were positive predictors of intended summer lawn watering behavior. Individuals who identified within one or both categories were more likely to indicate that they intended to use more water to maintain their residential lawns in comparison to respondents with weaker lawn preferences or stronger pro-environmental identities. This finding extends the existing empirical research on whether outdoor water consumption can be predicted by lawn preferences and environmental identities.

Second, we found that residential lawns fit the hero project framework. Lawns are considered desirable success symbols with the Canadian cultural worldview. Green and

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luxurious residential lawns provide an opportunity to support a culturally sanctioned project that produces feelings of cultural validation and self-worth. By successfully living up to one's cultural worldviews, people achieve a sense of symbolic immortality and existential security.

Third, if lawns are hero projects, then lawn watering should be an unconscious defensive response that arises with mortality reminders. Our initial finding was that mortality reminders may not impact intended lawn watering behavior even with individuals who hold strong lawn preferences. This finding may be the result of MS effects being eliminated by two-key moderating variables: high self-esteem and strong environmental identities. Our survey participants primarily consisted of individuals who strongly identified in both categories. This finding is consistent with the empirical TMT literature and informative for water efficiency policy and practice. It suggests that the presence or absence of mortality reminders is ineffective for motivating water consumption behavior changes by people who self-identify with strong pro-environmental identities and/or high self-esteem. Future water demand and urban efficiency research could focus on the possible MS effects on, and implications for, populations within low(er) self-esteem and/or weak(er) environmental identities. Such research should also consider how responses to MS differ during times of water scarcity or abundance.

Fourth, our study contributes to the methodological and case opportunities associated with applied TMT and mortality salience and awareness research. While we deviated from typical undergraduate participant, lab-based study design, we demonstrated that empirical TMT methods could be conducted in a non-clinical setting and with randomly-assigned, general-public participants. Future research efforts—whether conducted by scholars, environmental authorities or water utilities—could further refine and apply our methodology to understand hero projects and distal defensive patterns underpinning pro- or anti-environmental behaviors.

Our study offers water authorities an initial glimpse into the social psychological nuances underpinning residential water consumption decisions. Even the simple act of turning on—or off—the tap can be deeply tangled within individuals' cultural worldviews and their sense of self-esteem. These factors can influence their hero project pursuits such as socially sanctioned landscapes like lush, green lawns and other existentially motivated decisions. Authorities preparing conservation awareness campaigns may want to consider hero projects as a key variable within their target audience analysis. Until further research on water consumption and variables such as low(er) self-esteem and weak(er) environmental identities can be completed and given the potential influence mortality reminders can have over decision-making processes, we still suggest that implicit or explicit mortality reminders should be avoided and instead, statements should be framed with positive language. In the meantime, water authorities would benefit from identifying, understanding, and integrating the different water hero project opportunities in their communities and working to connect people to water sensitive hero projects.

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