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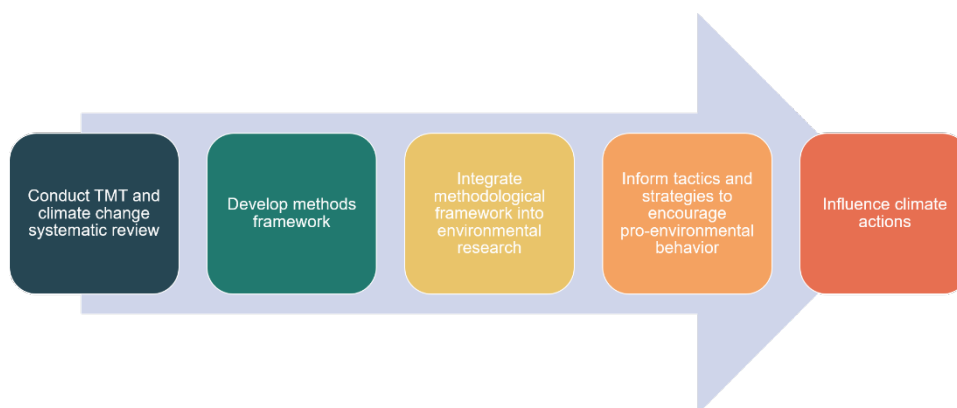
Abstract

Global climate change *awareness* is increasing, but efforts to convey information can trigger undesirable *behaviors*, including denial, scepticism, and increased resource consumption. It is therefore essential to more fully investigate social-psychological responses to climate information and messaging if we are to prompt, support, and sustain pro-environmental behaviors. Yet consideration of these responses is typically absent from interdisciplinary environmental study designs. Of specific relevance is research using social psychology's Terror Management Theory (TMT) showing that people's efforts to repress mortality salience or awareness significantly influence their attitudes, beliefs, and behaviors. Research on mortality salience's influence on climate change beliefs is progressing, but to date a systematic scoping review of the literature has been unavailable. Here, we provide such a review. We propose that TMT insights and methods must be better integrated into research designs to guide climate communications and to generate the comprehensive cultural and behavioral changes needed to address societies' climate problems. We introduce a methodological framework for interdisciplinary researchers to incorporate TMT into their research designs and help practitioners anticipate how their mortality-laden messaging could trigger unintentional social-psychological responses that degrade climate communication strategies.

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Visual Abstract

Terror Management Theory (TMT) methods should be used in environmental research to better understand how mortality fears influence pro- or anti-environmental behaviors. These new insights will help to structure interventions and improve efficacy of the efforts designed to encourage individuals' and societies' pro-environmental behavior.



Key Words: Climate change; Emotion; Pro-environmental behavior; Mortality awareness; Research methods; Sustainability; Terror Management Theory

1. INTRODUCTION

Climate changes will cause ever greater damage to our planet and endanger the wellbeing of all living species (Nordás & Gleditsch, 2015; Tschakert et al., 2019). Humanity remains dependent on a

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narrow, optimal range of ecological variation; human mortality rates are projected to increase due to extreme weather events, volatile temperatures, air pollution, and food and water insecurities (Lloyd et al., 2016; Phalkey et al., 2015; Santamouris, 2020; Schewe et al., 2019; Schilling et al., 2020; Shindell et al., 2020; Silva et al., 2017; Vesco et al., 2020). Various measures of physical and psychological health, including life expectancy, are expected to decline (Cunsolo & Ellis, 2018; Hauer & Santos-Lozada, 2021; Palinkas & Wong, 2020; Panu, 2020; Silva et al., 2017). Researchers anticipate that ecological disruptions will trigger radical 'symbolic' transformations and loss of traditions, spiritual and religious practices, identities, and cultural worldviews (Adger et al., 2013; Martin et al., 2020; McCarthy et al., 2014; Strauss, 2012; Tschakert et al., 2019). In short, future climate changes will disturb all human existence characteristics and should be recognized as one of the most significant sources of loss and existential threat to face the human species (Tschakert et al., 2017). Yet all levels of climate action are met with rationalization, avoidance, denial, scepticism, and increased resource consumption (Arndt et al., 2004; Hornsey et al., 2016; Whitmarsh, 2009; Whitmarsh, 2011).

Researchers continue to investigate *why* responses to climate information and solutions are met with such determined resistance (Clayton et al., 2015; Ho et al., 2017; Hulme, 2009; Nash et al., 2017; Newell et al., 2014; O'Brien & Wolf, 2010; Palm et al., 2020). One approach has been to examine socio-psychological barriers to climate change engagement and communication strategies to generate better environmental decisions (Bamberg & Möser, 2007; Bechtoldt et al., 2021; Klöckner, 2013; Markowitz & Guckian, 2018; Merkel et al., 2020; Moser, 2016; Nielsen et al., 2020; Osbaldiston & Schott, 2012; Reser & Bradley, 2020; Swim et al., 2009). We argue that persistent 'non-rational' climate behaviors – short or long-term behaviors that do not address climate change realities – can be partially explained by exclusion of existential threat management in climate change research and communications.

Terror Management Theory (TMT) can be used to test whether mortality reminders trigger predictable defensive behaviors that manage environmental terror and anxiety. But is mortality awareness so influential that millions of people will deny or avoid taking the necessary actions to circumvent the worst climate change impacts? Over 100 studies have compared mortality salience to other undesirable threat conditions such as uncertainty, meaninglessness, worries about the future, and physical pain (Cox et al., 2019; Pyszczynski et al., 2015, p. 43); it was the mortality salience condition that consistently produced statistically significant effects, demonstrating that there is indeed something unique about death fears (Pyszczynski et al., 2015; Routledge & Vess, 2019).

An extensive TMT literature spans hundreds of empirical studies over three decades but includes only a few climate studies. This presents a significant research opportunity as climate change projections indicate our lives – already imbued with mortality-linked messaging (Schmidt et al., 2013) – will become further saturated with both explicit (e.g., reported death counts) and implicit (e.g., coverage of extreme weather event risks) mortality reminders. If poorly understood or mismanaged, individuals' defensive responses – partially determined by their pre-existing identities – to these constant and intensifying mortality reminders could make environmental outcomes worse.

To better understand the intersection between environmental behaviors and mortality awareness, we completed a scoping review of published TMT-environment research methods and insights. Our objective was to establish a framework that would help emerging scholars integrate and advance the use of interdisciplinary TMT methods in their climate, environment, and sustainability research. Our review is both essential and timely: TMT can contribute necessary, novel insights to environmental communications and often-stalled climate policies. Simultaneously, established lab-based social psychology methods need to be consolidated and translated if these methods are to be integrated into in-situ pro-environmental research designs (Lede & Meleady, 2018). This methodological translation

will facilitate broader adoption of TMT methods that then generate the comprehensive behavioral changes needed to reconcile climate problems.

In this article we provide, first, an overview of TMT and its empirical foundations, implications for environment and climate change, and established TMT methods. Second, we present our systematic scoping review of TMT research methods specific to climate and environmental behavior research. We used our findings to develop a methodological framework for interdisciplinary researchers to

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2. THEORETICAL FOUNDATIONS

[2.1 Terror Management Theory, Cultural Worldviews, and Self-esteem]

Terror Management Theory (TMT) was designed to empirically test cultural anthropologist Ernest Becker's (1973) efforts to explain how the human desire to deny or transcend death influences behavior (Greenberg et al., 1986; Greenberg et al., 1990). TMT proponents claim that defenses against mortality awareness – the recognition of one's time-limited biological existence – without an immediate physical threat is a uniquely human 'by-product' of our cognitive abilities. The tension between humans' self-preservation instinct and mortality awareness generates potentially paralyzing existential terror that generally lingers at the edge of consciousness. We manage our existential fears through two interconnected *psychological structures*, cultural worldviews and self-esteem (Solomon et al., 1991). There is growing evidence for the role of close relationships as a third psychological structure (Cox et al., 2012; Florian et al., 2002; Mikulincer et al., 2002; Mikulincer et al., 2003), but we focus on the two substantiated structures due to robust empirical support and their integral role in TMT development.

Cultural worldviews are human-constructed shared belief and value system frameworks that outline criteria for how to live a meaningful life (Pyszczynski et al., 2015; Schimel et al., 2019). They influence how we think, what we feel, and why we act the way we do. Family recipes, clothing styles, and landscape preferences are shaped by cultural norms and practices. Cultural worldviews allow us to persist – whether literally or symbolically – beyond our biological death (Arndt & Solomon, 2003). Diverse worldviews offer ample opportunities to live forever literally, for examples, through body-preservation technologies or an afterlife (e.g., heaven), or symbolically, through long-lasting accomplishments, such as continuing family bloodlines through offspring, fame, or mega-infrastructure projects (e.g., large buildings).

Successfully meeting or exceeding our cultural worldview criteria for appropriate behavior yields self-esteem and the sense one is a valued member of their culture (Pyszczynski et al., 2015; Rosenblatt et al., 1989; Schimel et al., 2019). Self-esteem serves to reduce anxiety generally, and death anxiety in particular, stemming from childhood developmental experiences, according to attachment theory (Bowlby, 1969). Infants create bonds or attachments with caregivers – those responsible for childhood survival – and these relationships help them develop a sense of self and 'other' (Bowlby, 1969), create connections to their culture, and result in societal self-esteem criteria (Koç & Kafa, 2019). As children learn about mortality and parental imperfections, they seek protection and self-esteem from society and culture over imperfect, mortal caregivers (Yalom, 1980). These early, parental attachments mediate childhood anxiety similar to the ways that cultural self-esteem buffers adults' death anxieties (Pyszczynski et al., 2004). To fend off existential terror, we are driven to derive value from self-esteem, uphold cultural belief systems or worldviews, and seek close relationships with others (Hart et al., 2005; Mikulincer et al., 2003). When these elements are threatened, we react defensively.

Since cultural worldviews vary across nations and even within smaller communities, a self-esteem source for one may contribute to alienation and ridicule for another. Recognition and validation from others within our cultural milieu support and elevate self-esteem. Self-esteem deteriorates when we become disenchanted with our cultural worldview during crises, conflicts, or cultural interruptions or when we struggle with our self-worth because of a perceived failure to meet cultural expectations (Pyszczynski et al., 2015).

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[2.2 Terror Management Theory Hypotheses, Evidence of Psychological Defenses, and Potential Research Expansion]

[2.2.1 Terror Management Theory Hypotheses]

Terror Management Theory (TMT) research is organized around three core hypotheses: anxiety-buffer, mortality salience, and death-thought accessibility (Table 1, summarized from Pyszczynski et al., 2015).

Table 1

Terror Management Theory's Core Hypotheses

Anxiety-Buffer Hypothesis	If a psychological structure buffers anxiety, then bolstering that psychological structure should reduce anxiety when threatened with a mortality reminder.
Mortality Salience Hypothesis	If a psychological structure provides protection from death-thoughts, then mortality reminders should increase one's need for protection from these psychological structures.
Death-Thought Accessibility Hypothesis	If a psychological structure provides protection from death-thoughts, then threatening the psychological structure should increase accessibility of death-related thoughts.

The *anxiety-buffer* (AB) hypothesis focuses on how psychological structures act as defensive 'buffers' to reduce anxiety and death-concerns following a threat (e.g., a mortality reminder) (Juhl & Routledge, 2016), thus reducing the need to activate death anxiety defenses (Greenberg et al., 1993; Harmon-Jones et al., 1997). Research using the AB hypothesis has deepened our understanding of the self-esteem psychological structure.

The *mortality salience* (MS) hypothesis allows researchers to explore how psychological structures are protected and reinforced when subjected to mortality reminders (Pyszczynski et al., 2015). It states that if cultural worldviews, self-esteem, and close relationships mitigate existential terror, then asking people to ponder their own mortality, i.e., inducing MS, should increase the need for the protection provided by these psychological structures. This hypothesis is the most frequently tested, used in 83% of TMT studies (Burke et al., 2010, p. 156). These experiments have contributed significantly to the dual-process defense model (Section 2.2.2), tested a vast range of human behaviors linked to death defenses, and identified many types of external stimuli that elicit MS (Burke et al., 2010; Cox et al., 2019).

Finally, the *death-thought accessibility* (DTA) hypothesis is used to examine how threats to psychological structures (e.g., threatening participants' self-esteem or challenging their worldviews) increase accessibility of death-related thoughts percolating beyond focal attention (Schimel et al., 2007). Empirical findings have indicated that DTA increases following threats to cultural worldviews or self-esteem (Schimel et al., 2019). Other studies have found that DTA increases when relationships, the human-animal boundary, and structured meaning, i.e., efforts to maintain simple, orderly understandings of reality, are threatened, suggesting that these components are also important to existential security and psychological well-being (Schimel et al., 2019; Swanson & Landau, 2019). Together, these results suggest that high implicit DTA is associated with the activation of distal defenses – one of two distinct defenses in the dual-process defense model – when death-thoughts leave consciousness. Therefore, DTA studies have not only been essential for understanding TMT cognitive processes and developing the dual-process defense model but, have also helped predict how people respond when their cultural belief systems are challenged or self-image is sabotaged (Hayes et al., 2010; Schimel et al., 2007).

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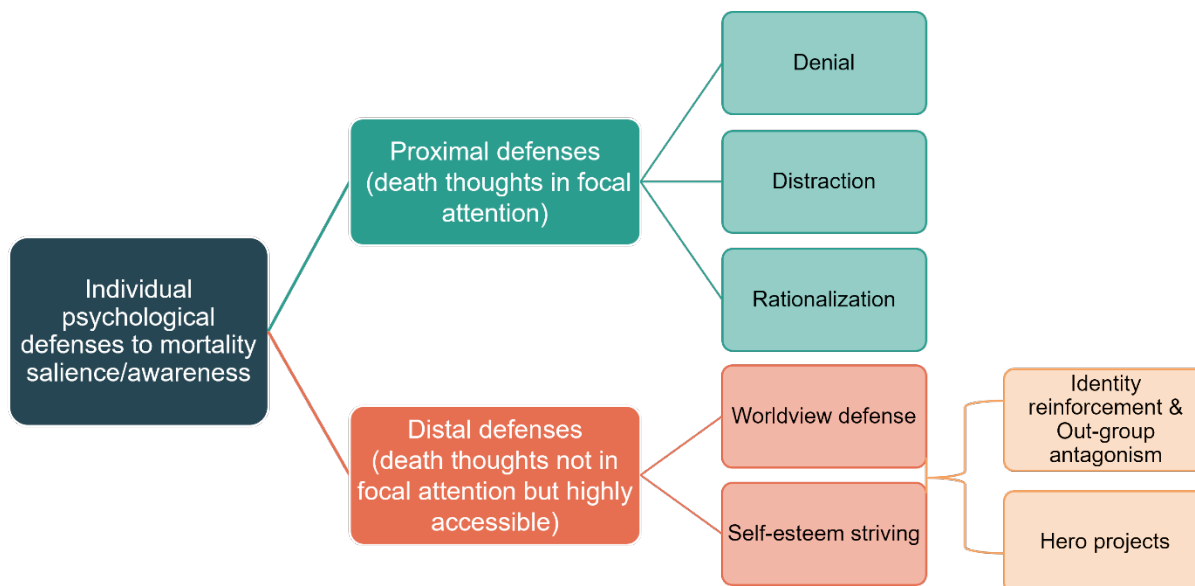
[2.2.2 Evidence of psychological defenses against mortality awareness]

Social psychologists using TMT propose that humans will go to great lengths to avoid thinking about death, to defend their worldviews, and to bolster their self-esteem. Empirical TMT studies have organized these behavioral patterns in a dual-process defense model (Pyszczynski et al., 1999) that distinguishes between proximal and distal cognitive phases (Figure 1).

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Figure 1

Terror Management Theory's Psychological Defenses to Mortality Salience or Awareness (adapted from Wolfe & Tubi, 2018)



For many, contemplating one's mortality, and anything that undermines or challenges our psychological structures, can be deeply destabilizing. Mortality salience can be reliably triggered in multiple ways (Cox et al., 2019), but effects are strongest when people purposely contemplate their own mortality. For example, participants may be asked to write about their own death, to view graphic death images, or have the word "death" flash imperceptibly on a screen as they complete an unrelated task. Control participants are triggered by painful-but-non-fatal reminders, such as dental pain. Researchers working outside social psychology may refer to mortality 'awareness', rather than salience, when speaking about triggers that occur outside of a clinical research context (Wolfe & Tubi, 2018).

In response to death reminders, *proximal defenses* activate to 1) suppress death-thoughts that creep into focal attention, and 2) shift unwanted death-thoughts out of focal attention by rationalizing away, distracting from, or denying one's vulnerabilities (Pyszczynski et al., 1999). For example, upon seeing the health warning on a cigarette package, a smoker might tell themselves they will quit next week, hide the label image, or remind themselves that they are young, active, and not a cancer risk. Yet, in recent TMT-health studies, if proximal threats are paired with proximal, positive, vulnerability reducing incentives, some people chose healthier behaviors (e.g., quitting smoking); it is important to consider mediating variables in TMT research (Arndt et al., 2006).

Although counterintuitive, death-thoughts and existential concerns are not easily accessible during the proximal phase because we are unconsciously – but effortfully – suppressing death-thoughts. We very efficiently shift and keep death-thoughts out of focal attention to avoid dealing with our distressing existential reality. Therefore, death-thought accessibility (DTA) is 'low' during the proximal phase.

Once death-thoughts are outside focal attention, but nevertheless highly accessible, *distal defenses* activate lower DTA by strengthening and maintaining self-esteem, identities, and worldview allegiances (Arndt & Solomon, 2003; Goldenberg et al., 2001; Landau et al., 2004). These defensive responses often have nothing to do with death itself but instead are directly linked to cultural contexts and immortality pursuits. Both defenses are critical for unconsciously subduing death-related concerns and lowering DTA. Since distal defenses are not associated with minimizing risk or avoiding death, behaviors can be paradoxical in nature: people may put their own lives at risk for a cause that

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Over decades, TMT researchers have tested, retested, and reconfigured the three TMT hypotheses to investigate psycho-social phenomena associated with human mortality responses. While some researchers claim replicability issues, carefully following prescribed TMT procedures is essential for finding and replicating MS effects (Chartrand et al., 2020). Furthermore, researchers are examining the neural responses that shield us from existential threat awareness; they have shown for the first time “a plausible neural-based mechanism of death-denial” (Dor-Ziderman et al., 2019, p. 1). Using mortality priming, TMT researchers’ empirical efforts have revealed consistent and predictive responses in human behavior – whether benign or malicious – that might be considered ‘irrational’ or ‘illogical’. The theoretical framework has been applied to explain motivations underlying COVID-19 responses, political party preferences or affiliations, reading comprehension of same vs. opposing worldviews, discrimination, and racial justice (Abulof et al., 2021; Brandt-Law & Krauss, 2017; Cohen et al., 2017; Courtney et al., 2020; Fairlamb & Cinnirella, 2020; Pyszczynski et al., 2021; Solomon, 2021; Williams et al., 2012; Vail et al., 2019). Findings consistently confirm that MS intensifies cultural worldview defense, self-esteem striving, and desire for close relationships.

What TMT represents, according to Solomon (S. Solomon, personal communication, July 12th, 13th, and 26th, 2021), is a “paradigm shift in social psychology...[where] experimental methods could be employed to address existential questions previously deemed to be beyond the scope of empirical inquiry”. This shift allowed for the expansion of what could be considered normal science and, more critical for our interests, the integration of new disciplines and questions. Applying TMT ideas and methods beyond its original domain has a precedent in Goldenberg and Arndt’s (2008) work on human health – including work on tanning, smoking, fitness, and health promotion efforts – and “has generated an impressive body of empirical support with a host of important applied implications” (S. Solomon, personal communication, July 12th, 13th, and 26th, 2021; see also: Arndt et al., 2003; Courtney et al., 2020; Goldenberg & Arndt, 2008). With this human health application (Sidebar 1), TMT has been established as a viable framework to understand human behavior in a new way: it rejects humanity as rational, truth-seeking risk assessors and recognizes us as the fallible, defensive, existential terror-managing creatures we are. While no scientist would argue that mortality management is sufficient to explain all behavior, it has been shown to be a necessary variable.

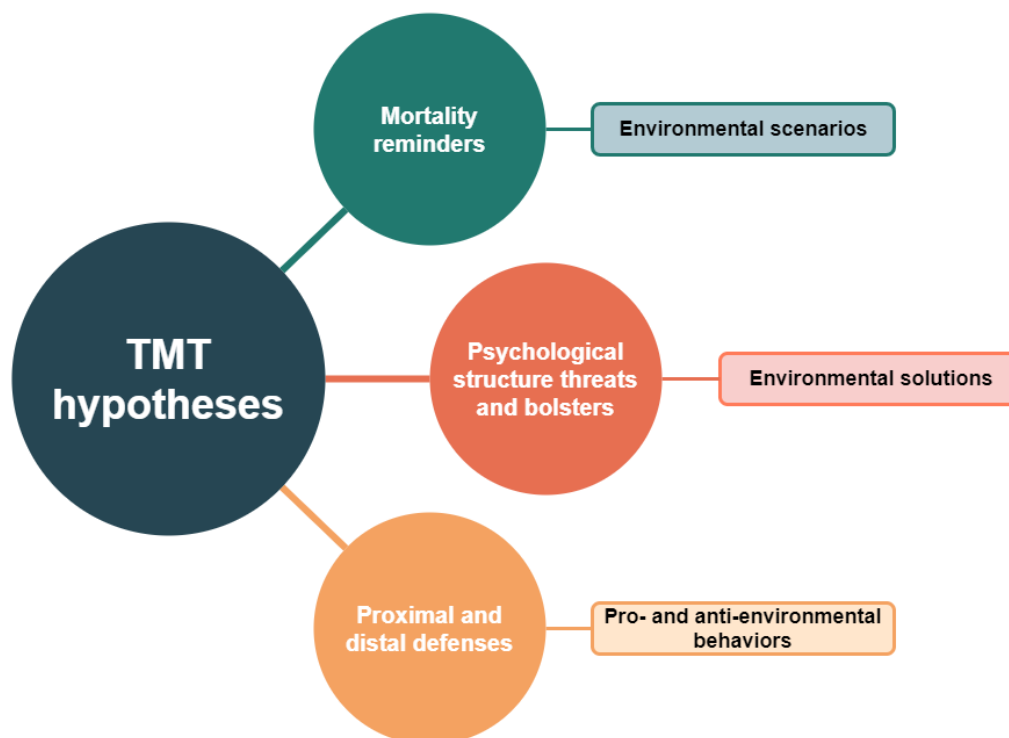
[2.2.3 Implications of terror management defenses for society-environment interactions]

The extension of TMT thinking to environment-focused research is now essential: the theoretical construct and methods offer powerful insights to a field struggling to create and sustain pro-environmental behavioral and policy changes within a global climate of pervasive and increasing mortality fears. Decades of increasingly interdisciplinary TMT inquiry offers a clear understanding about *what* external mortality-laden stimuli may trigger certain defensive behaviors, *how* these behaviors are connected to our psychological structures, and *when* we might expect to notice these behaviors, i.e., during proximal or distal cognitive phases (Harvell & Nisbett, 2016; Routledge & Vess, 2019). This presents intriguing opportunities to gauge whether humanity’s response to environmental problems can also be partially explained by mortality awareness. The framework and methods have been vastly underutilized yet offer exciting new opportunities for environment-focused researchers. We describe three key areas for how the TMT framework can be extended to – and extremely valuable for – multiple social-environmental inquiries (Figure 2).

Figure 2

Extending Key Elements of Terror Management Theory to Three Lines of Social-Environmental Research

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First, TMT can be used to determine which environmental scenarios, for example, climate change, drought, fire, or flood, perform as mortality reminders. Scholars have offered strong theoretical rationales for why environmental scenarios *could* have this role (Cote et al., 2017; Dickinson, 2009; Koole & Van Den Berg, 2005; Van Kessel, 2020; Wolfe & Brooks, 2016; Wolfe & Tubi, 2018). Early TMT studies indicate that climate change threats are capable of triggering both negative and positive environmental outcomes by influencing attitudes and behaviors in similar ways to mortality reminders (Fritsche et al., 2012; Fritsche et al., 2010; Fritsche & Häfner, 2012). However, whether it is appropriate to classify these environmental scenarios as mortality reminders, what climate change aspects specifically elicit TMT responses, and what other environmental scenarios may act similarly, remains open to debate (Barth et al., 2018; Fritsche et al., 2012; Pyszczynski et al., 2012; Uhl et al., 2018). Further empirical testing is needed to establish whether these scenarios trigger implicit or explicit death-thoughts so we can predict subsequent proximal and distal defenses. These predictions will have implications for how to mitigate or intensify such defenses, depending on the desired outcome (e.g., how to increase pro-environmental behaviors).

Second, TMT can be used to determine how proposed environment or climate solutions threaten or bolster psychological structures such as cultural worldviews and self-esteem. Environmental behavior researchers offer various explanations for why people are slow to adopt – or outright reject – new behaviors that result in positive individual, societal, and global environmental outcomes (Gifford, 2011; Hornsey & Fielding, 2020; Sharman & Perkins, 2017; Stankuniene et al., 2020). Since researchers have tended to gloss over the deeply held psychological structures that protect us from existential terror, requests that challenge those structures, even for a ‘simple’ behavior change, may not actually be straightforward. This reality has important implications for how proposed solutions are framed and targeted to groups based on their identities, emotions, and values. For some individuals or groups, behavior change efforts may require major shifts to their cultural identity and self-esteem sources.

Third, TMT can be used to identify what pro- or anti-environmental behaviors serve as proximal and distal defenses and when those defenses are likely to occur. Mortality defense consequences are not always negative; mortality reminders may prompt pro-environmental behaviors in some populations (Fritsche et al., 2010). For example, Vail and Juhl (2015, p. 4) argued that “positive terror

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As a mechanism for exploring climate change responses, TMT provides established empirical insights that are robust and replicable, utilizes a near-universal threat (death), and has been applied across diverse populations in more than 25 countries (Pyszczynski et al., 2015). TMT allows us to ask questions in environmental contexts that can help identify when and how to strategically use mortality reminders to reduce negative behaviors or increase positive responses. Considering the massive, anticipated climate impacts, the growing media coverage with near constant exposure to climate messaging, it is crucial to expand the interface of TMT and broadly defined environment research.

3. METHODS REVIEW AND FINDINGS

[3.1 Methodology]

We completed a scoping review to identify how TMT has been used in empirical environmental or climate-related research. Our review followed established review procedures developed by PRISMA-ScR and the Joanna Briggs Institute (Lockwood et al., 2019; Moher et al., 2009).

Three databases—Scopus, Web of Science, JSTOR—were selected for their social science focus and comprehensive coverage. These databases were searched for English language, peer-reviewed, and published articles. Search strategies included keywords and syntax specific to the journals' databases. Diverse search terms and keywords were designed to capture records that explicitly and implicitly used TMT for environmental research using keywords of:

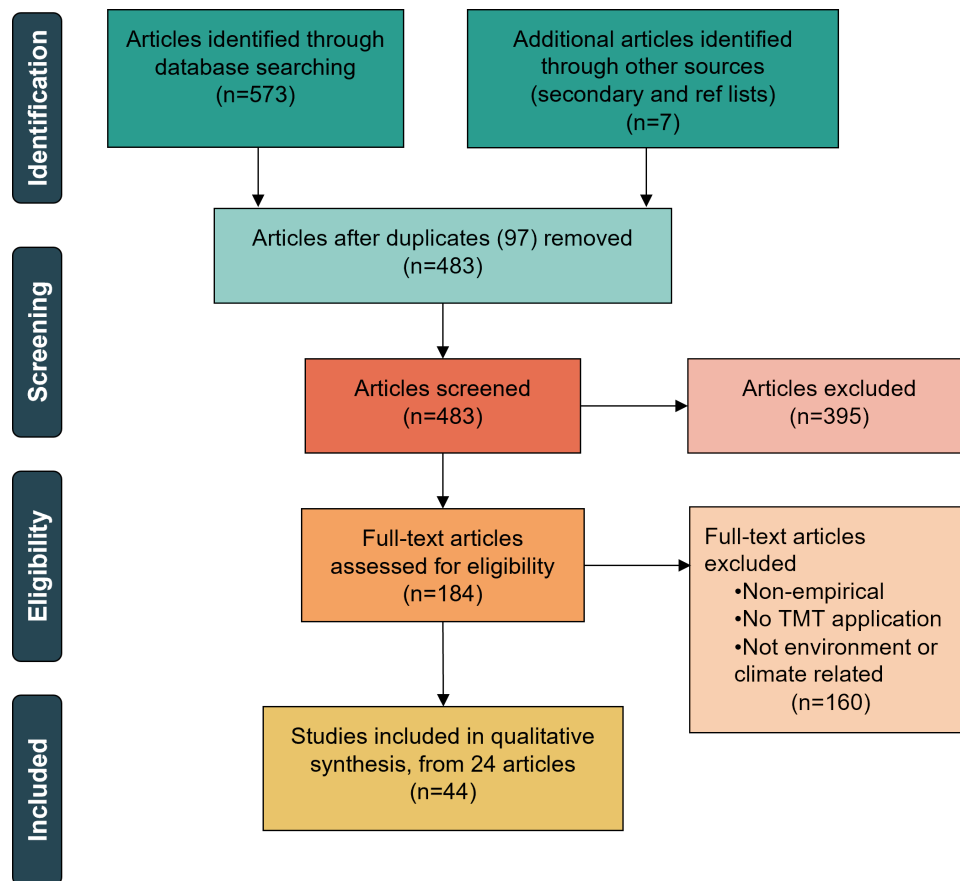
“("terror management theory" OR "mortality salience" OR "mortality awareness" OR "death awareness" OR "death anxiet*" OR "death reminder*" OR "mortality reminder*" OR "existential anxiet*") **AND** ("climate change" OR "global warming" OR "environment*" OR "sustainab*" OR "unsustainab*" OR "environmental behav*" OR "pro-environment*" OR "environmental communication*")”.

Our initial data set (n=580) was compiled in an Excel spreadsheet; duplicate articles (n=97) were removed. A manual title and abstract scan excluded articles that were unrelated to environmental research (e.g., focused on medical research) or were non-empirical studies (e.g., reviews or theoretical papers) that did not rely on primary data (n=395). Our penultimate data set (n=184) was reviewed by all authors to identify 44 studies within 24 articles for final analysis. Where discrepancies emerged, e.g., when one author felt an article should be included in the review but another did not, the article was included to ensure no potential insights were lost. Figure 3 shows the flow diagram of this screening process.

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Figure 3

Scoping Process Flow Diagram, Indicating Articles Included and Excluded, With Rationales



The articles were organized in Excel to track key themes and general characteristics of author and journal discipline, methodologies and methods, study design, geographic region, and time period. These descriptive features can be found in Appendix A along with study methods summaries in Appendix B. Table 2 offers a descriptive article summary, including TMT defense (i.e., proximal vs. distal), research aims, and results. Trends regarding environmental applications were also tracked and can be found with methodological descriptions in Section 3.2.

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Table 2

Descriptive Summary of Articles Using Terror Management Theory Insights for Environmentally Themed Research

Article	# of Studies	Study Design	Defense(s) of Interest	Aim or Purpose	Results
Akil et al., 2018	1	Experimental	Distal	Identify effectiveness of anxiety-inducing communication for mobilizing consumers against climate change.	Mortality-laden climate messaging increases pro-materialistic consumer choices for those of a materialistic worldview and increases pro-environmental consumption for those of an environmental worldview.
Atalay & Meloy, 2020	3	Experimental (All)	Distal (S1 & S2); Proximal (S3)	Clarify why people fail to follow evacuation recommendations when facing extreme weather.	MS increases following exposure to natural disasters and extreme events; this heightened MS makes evacuation unappealing due to low locus of control. If control is high (e.g., choice in evacuation options) compliance increases. Climate change threat led to stronger derogation of those who went against group norms. Depending on the ingroup and norms primed, climate change threat resulted in group-based defenses.
Barth et al., 2018	3	Experimental (All)	Distal (All)	Evaluate whether climate change threat increases ingroup norms and group-based defenses.	Request for pro-environmental behavior was initially successful but diminished with existential threat.
Buttler et al., 2017	2	Quasi-Experimental (All)	Distal (All)	Characterize change in environmental behaviors when faced with threat (nuclear disaster reminder).	Walkerton media coverage utilized negative emotions, associated with MS, and proximal and distal defenses were noted. This persisted over time, indicating the event was a powerful mortality reminder.
Cote et al., 2017	1	Qualitative	Both	Analyze fear and negative emotions in media coverage of the Walkerton water contamination crisis with TMT lens, considering the influence on social and individual decisions.	Pro-bottled water advertising offered greater potential for death anxiety management; The ads included more diverse and robust messages that would appeal to a wide-ranging audience compared to public anti-bottled water
Cote & Wolfe, 2017	1	Qualitative	Both	Assess pro- and anti-bottled water campaigns in Canada with TMT lens to recommend more effective environmental communication tactics.	

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					communications, supporting audience self-esteem, allowing audiences to engage worldview defenses, and symbolically extending viewers' lives.
Fritsche et al., 2010	3	Experimental (All)	Distal (All)	Investigate if perceived threat might enhance pro-environmental behavior when pro-environmental norms are salient.	MS increased pro-environmental behavior only when related norms were salient. Norm salience only influenced pro-environmental attitudes and behavior when personal mortality threat was salient.
Fritsche et al., 2012	3	Experimental (All)	Both (S1A); Distal (S1B & S2)	Explore how climate change as a mortality threat can influence authoritarian attitudes.	Reminding participants of negative climate change consequences for their country increased authoritarian attitudes and derogation of anti-social groups. Climate change threats increased system justification and support for system supporting groups (e.g., judges) in those who identified with their nation. MS decreased biocentric motivations but not anthropocentric; death awareness reduced motivation to protect the natural environment for its intrinsic value. If people view pro-environmental behaviors as serving humans or involving people's identities, negative existential threat effects on pro-environmental motivation can be eliminated.
Fritsche & Häfner, 2012	2	Experimental (All)	Distal (All)	Characterize how mortality salience influences environmentally relevant motivations to protect the environment.	MS increases eco-guilt when pro-environmental individuals have environmental values made salient. MS did not influence eco-guilt for less environmental individuals, with or without salient environmental values.
Harrison & Mallett, 2013	1	Experimental	Distal	Articulate the interaction of pro-environmentalism and mortality salience on collective eco-guilt.	MS led participants to more highly value future generations' only in comparison with the neutral condition. MS decreased participants' valuation of social SDGs when compared to both control conditions, and valuation of ecological SDGs only when compared to the neutral condition.
Hu et al., 2018	1	Experimental	Distal	Test influence of mortality salience on intergenerational altruism and perceived importance of the Sustainable Development Goals.	

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Kasser & Sheldon, 2000	2	Experimental (All)	Distal (All)	Examine whether mortality salience and/or security influences materialism.	MS led to higher financial expectations compared to control and led to greater consumption of resources in a forest-management game. Insecure feelings from MS led to materialistic behavior.
Koole & Van Den Berg, 2005	4	Cross-Sectional (S1); Experimental (S2, S4 & S5)	Proximal (S1); Distal (S2, S4 & S5)	Consider how mortality salience influences evaluations of wilderness (TMT used in 4 of 5 studies).	Wilderness evokes death-thoughts and led to its negative evaluation. Action-oriented individuals better avoided negative wilderness thoughts following MS than state-oriented individuals, unless death reminder was explicit.
Lifshin et al., 2016	2	Experimental (All)	Distal (All)	Assess symbolic immortality and mortality salience influence on reactions to end-of-the-world threats.	Symbolic immortality thoughts led those with high soul belief to be as resistant to an end-of-world threat as those with low soul belief.
Mann & Wolfe, 2016	1	Experimental	Distal	Explore mortality salience effects on residential flood risk perceptions in Toronto, Canada, to determine MS impacts on environmental behavior and decision making.	Existential anxiety more likely influences flood risk perceptions through worldview defense when flooding social dimensions are salient. No significant difference in flood risk perceptions was found between MS and control.
Pyszczynski et al., 2012	3	Experimental (All)	Distal (All)	Investigate influence of mortality salience or climate change on support for war versus peacebuilding	Considering global climate change as a shared human threat can promote peacebuilding and reduce support for war. MS increased support among Americans for international peace after global climate threat but not local threat. MS increased peace support among those with high perceptions of shared humanity, among Arab Israeli citizens.
Rahimah et al., 2018	1	Cross-Sectional	Distal	Appraise the influence of mortality salience on environmental purchasing attitudes	Death anxiety affects green purchasing attitude and green purchase intention via degree of environmental concern and pro-environmental behavior of consumer.
Rahimah et al., 2020	1	Cross-Sectional	Distal	Question mortality salience influence on consumers' sustainability attitudes while also considering religiosity.	MS and self-esteem increase materialism. Materialism increases consumers' sustainability attitudes. Religiosity strengthens

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Ross & Wolfe, 2016	1	Qualitative	Both	Identify mortality salience in media surrounding Hoover dam's preconstruction, construction, and postconstruction, to explore symbolic immortality linkages and underlying influences on water decisions.	MS effects on materialism and weakens materialism effects on green concern. MS was abundant in media concerning Hoover Dam during all stages; Hoover Dam may have served as a hero project for those involved in its installation.
Selimbegović et al., 2016	3	Experimental (All)	Distal (S1, S3); Both (S2)	Test the effect of threatening nuclear accident reminders versus mortality reminders on attitudes toward nuclear energy.	Nuclear accident reminders were parallel in effect to those from mortality reminders. Nuclear accident reminders increased nuclear energy support among those with negative environmental protection attitudes and lasted up to 2 weeks (S2).
Uhl et al., 2018	1	Experimental	Distal	Determine the influence of threat and ingroup affirmation on response to climate change information in individualist (Austrian) and collectivist (Argentinian) cultures.	A threatening climate change message resulted in lower pro-environmental behavior intentions, but only significantly in Austria (individualist). Ingroup affirmation marginally increased, rather than reduced, ethnocentrism, a symbolic response to climate change threat.
Vess & Arndt, 2008	1	Experimental	Distal	Research the influence of MS on environmental concern while considering whether individual derives self-esteem from environmental action	Mortality awareness led to lower environmental concern among those who do not gain self-esteem from the environment but increased environmental concern for those who obtain self-esteem from environmental action.
Vess et al., 2012	3	Cross-Sectional (S1); Experimental (S2 & S3)	Distal (All)	Examine the relationships between mortality salience, religiosity, and connectedness to nature.	When death-thoughts primed, religiosity was negatively related to connectedness to nature; no relationship emerged without death-thoughts.
Wang & Chao, 2020	1	Experimental	Distal	Investigate mortality salience influence on nostalgia and environmental purchasing attitudes.	Nostalgic participants showed higher green product purchase likelihood when MS was low rather than high.

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Some articles included both proximal and distal defenses (n=5; 11%) but most studies focused on distal (n=37; 84%) and the fewest focused on proximal defenses (n=2; 5%).

[3.2 THEMES AND TRENDS ACROSS ENVIRONMENTAL MORTALITY SALIENCE RESEARCH]

Studies were analyzed to identify 1) themes and trends across designs and methods, and 2) how the studies compared to TMT methodologies as described in Cox et al.'s (2019) methodological review chapter in the *Handbook of Terror Management Theory*. A thorough compilation of TMT methodology and methods, written and edited by TMT experts, this chapter is the most recent, comprehensive summary of all TMT research to date. It served as a guide for critically assessing the TMT-environment studies' methods.

[3.2.1 Implementation of Terror Management Theory Methods]

In our assessment, key elements were the mortality salience inductions (i.e., measures), control presence and type, delay presence and number, and environmental applications.

[3.2.1.1. Mortality Salience Inductions]

To study terror management processes, death-related thoughts must be rendered momentarily salient in participants' minds. Mortality salience can be induced explicitly or implicitly. A 20-year meta-analysis of TMT research (Burke et al., 2010, p.177) noted that the most common (79.8%) explicit MS induction involved two open-ended questions about 1) the emotions aroused from the thought of one's death, and 2) what physically happens to oneself once physically dead. Other common MS inductions are fear of death or death-anxiety scales^a. These inductions make mortality explicitly salient and bring death-thoughts to consciousness.

Other mortality priming inductions are implicit and even subliminal. Examples include quick decision-making tasks, viewing threatening images or text during an unrelated activity, conducting the experiment in or near threatening conditions, for example, outdoors near a cemetery or indoors during a hurricane, or subliminal presentations of "dead" or "death". These implicit methods directly evoke distal MS defenses, as demonstrated by Fritsche et al. (2010). When explicit mortality reminders and distal defenses are required, a delay is necessary for the threat to reach subconscious levels (Cox et al., 2019). This process is discussed in more detail in Section 3.2.1.3.

In our review, studies were found to most often utilize explicit death primes, such as the Mortality Attitudes Personality Survey (MAPS) or Projective Life Attitudes Assessment (PLAA) (n=17; 39%, Table 3), typical of most TMT research (Cox et al., 2019; Burke et al., 2010).

Table 1

Mortality Representation and/or Measurements Present in Studies Surveyed

Mortality salience induction and/or measure	# of Studies	Source	Study #
Explicit written mortality reminders (e.g., MAPS, PLAA)	17 (39%)	Atalay & Meloy, 2020	S1 & S2
		Fritsche et al., 2010	S1
		Fritsche & Häfner, 2012	All
		Harrison & Mallett, 2013	All
		Hu et al., 2018	All
		Kasser et al., 2000	All
		Lifshin et al., 2016	S4
		Pyszczynski et al., 2012	All
		Selimbegović et al., 2016	S2
		Vess & Arndt, 2008	All
Vess et al., 2012	S2		

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		Wang & Chao, 2020	All
		Barth et al., 2018	All
Climate change as mortality reminder	9 (20%)	Atalay & Meloy, 2020	S3
		Fritsche et al., 2012	All
		Selimbegović et al., 2016	S1
		Uhl et al., 2018	All
		Fritsche et al., 2012	S2 & S3
Subliminal mortality (e.g., lexical decision task, death word in background)	5 (11%)	Koole & Van Den Berg., 2005	S4 & S5
		Selimbegović et al., 2016	S3
		Koole & Van Den Berg, 2005	S2
MS survey (e.g., Fear of Death Inventory)	4 (9%)	Rahimah et al., 2018	All
		Rahimah et al., 2020	All
		Vess et al., 2012	S3
		Buttler et al., 2017	All: nuclear threat
Threat/reminder within messaging or signage	4 (9%)	Lifshin et al., 2016	S4 & S5: global warming end-of-world
		Cote & Wolfe, 2017	All
Content analysis	3 (7%)	Cote et al., 2017	All
		Ross & Wolfe, 2016	All
		Vess et al., 2012	S1
DTA measure only	1 (2%)	Vess et al., 2012	S1
Location of death-thoughts (occurring in wilderness vs. urban)	1 (2%)	Koole & Van Den Berg, 2005	S1

Climate change or other environmental scenarios were used as threat primes in nine studies (20%). These studies were designed to test whether climate change threats functioned similarly to mortality threats or reminders, providing important insights for climate change communication strategies. Other studies examined here focused on MS influence on pro-environmental intentions, values, or worldviews, or analysed the presence of MS defenses in or around environmental events, e.g., research conducted during or following an extreme weather event.

[3.2.1.2. Control Types]

For studies using experimental methods, controls are necessary to understand what happens when mortality is not salient. In typical TMT research, control questions often ask about dental pain—as a painful but not death related prime—or neutral thoughts. In our review, 13 studies (32%) utilized dental visits or pain and five (12%) used a non-threatening environment-related message as a control group, as shown in Table 4. Some studies (n=4; 10%) used multiple control groups, for example, to explore whether an environmental concept evokes similar response to MS, while others (n=4; 10%) used mortality in comparison to neutral and aversive controls (e.g., participants were subliminally shown either "death", "xxx", or "pain"). Overall, our review showed that there was diversity among controls, with eight (20%) studies using controls unique to their study.

Table 2

Mortality/Climate Threat Controls Used in Studies Surveyed

Control Type	# of Studies	Source	Study #: Type of control
Dentist/dental pain	13 (32%)	Fritsche et al., 2010	S1 & S2
		Harrison & Mallett, 2013	All
		Hu et al., 2018	All
		Koole & Van Den Berg, 2005	S5
		Lifshin et al., 2016	S4
		Pyszczynski et al., 2012	S1 & S3
		Selimbegović et al., 2016	S1 & S2
		Vess & Arndt, 2008	All

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		Vess et al., 2012	S3
		Wang & Chao, 2020	All
Other	8 (20%)	Barth et al., 2018	S1 & S3: trivia S2: high vs moderate climate change threat
		Koole & Van Den Berg, 2005	S1: thoughts other than death
		Lifshin et al., 2016	S5: boredom
		Hu et al., 2018	All: groceries
		Mann & Wolfe, 2016	All: wine production & climate change
Non-threatening climate/ environmental	5 (12%)	Pyszczyński et al., 2012	S2: uncertainty
		Akil et al., 2018	All
		Fritsche et al., 2012	All
		Uhl et al., 2018	All
		Hu et al., 2018	All: MS vs dentist vs groceries
Multiple controls/ comparisons	4 (10%)	Koole & Van Den Berg, 2005	S5: "death" vs "xxxx" vs "pain"
		Selimbegović et al., 2016	S2: MS vs dentist vs Fukushima S3: neutral vs nuclear vs failure
Neutral or non- words	4 (10%)	Fritsche et al., 2012	S3
		Koole & Van Den Berg, 2005	S4 & S5
		Selimbegović et al., 2016	S3
Music, TV	4 (10%)	Atalay & Meloy, 2020	S1 & S2
		Kasser & Sheldon, 2005	All
Failure	2 (5%)	Selimbegović et al., 2016	S3: failure related words
		Vess et al., 2012	S2: failing an exam
No MS control	1 (2%)	Atalay & Meloy, 2020	S3: during hurricane, MS was independent variable

[3.2.1.3. Delays]

Delay tasks are required when using explicit mortality reminders and investigating distal defenses. Delays allow the participants' death-thoughts to reach their subconscious and activate, for example, self-esteem striving, worldview bolstering, or fostering close relationships. Decades of TMT research have found that two or more delays, lasting 7 – 20 minutes in total, result in stronger effects than fewer delays that last less than six minutes (Burke et al., 2010). The distal defense studies we reviewed did not consistently report delay time but described number of delays implemented (Table 5).

Table 3

Delays Present in Studies Interested in Distal Defenses

# of Delays	# of Studies	Source	Study #
Two or more Delays	22 (54%)	Akil et al., 2018	All
		Atalay & Meloy, 2020	S1
		Barth et al., 2018	S1 & S2
		Fritsche et al., 2012	All
		Fritsche & Häfner, 2012	All
		Fritsche et al., 2010	S1
		Hu et al., 2018	All
		Koole & Van Den Berg, 2005	S2 & S5
		Mann & Wolfe, 2016	All
		Pyszczyński et al., 2012	S3
		Rahimah et al., 2018	All

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		Rahimah et al., 2020	All
		Selimbegović et al., 2016	S2 ¹
		Vess & Arndt, 2008	All
		Vess et al., 2012	S2 & S3
		Wang & Chao, 2020	S3
		Atalay & Meloy, 2020	S2
		Barth et al., 2018	S3
		Buttlar et al., 2017	All ²
		Fritsche et al., 2010	S2 & S3
One Delay	14 (32%)	Kasser et al., 2000	S1
		Koole & Van Den Berg, 2005	S4
		Lifshin et al., 2016	S4 & S5
		Pyszczynski et al., 2012	S1 & S2
		Uhl et al., 2018	All
		Vess et al., 2012	S1
No delay	5 (11%)	Fritsche et al., 2012	S1A ³
		Harrison & Mallett, 2013	All
		Kasser et al., 2000	S2
		Selimbegović et al., 2016	S1 & S2 ¹

¹Dependent variable (DV) at T1 no delay, T2 12 days later
²Distance between threatening poster and DV was the delay, exact delay length unknown
³Fritsche et al., 2012 S1A used delay as independent variable, so is in two categories

In over half of the studies (n=22; 54%), two or more delays were used more often than reported in Burke et al.'s meta-analysis (22%; 2010, p. 177). This increased delay use may be because all review studies were published after the dual-process model was established as necessary for research design and the need for delays to access distal defenses had been recognized (Pyszczynski et al., 1999).

[3.2.2. Climate change and environmental applications]

The studies demonstrated diverse connections to climate change and environment (Table 6).

Table 4

Study Representation of Climate Change and Environment

Climate change or environment portrayal	# of Studies	Source	Study #
Environmental values or identity measure (e.g., Connectedness to Nature Scale, Environmental Contingencies of Self-Worth)	20 (33%)	Akil et al., 2018	All
		Barth et al., 2018	All
		Fritsche et al., 2010	S1
		Fritsche et al., 2012	All
		Fritsche & Hafner, 2012	All
		Harrison & Mallett, 2013	All
		Rahimah et al., 2018	All
		Rahimah et al., 2020	All
		Selimbegović et al., 2016	S1 & S2
		Uhl et al., 2018	All
		Vess & Arndt, 2008	All
		Vess et al., 2012	All
Climate change as catastrophe (global, local, and/or ongoing)	7 (12%)	Atalay & Meloy, 2020	All
		Cote et al., 2017	All
		Pyszczynski et al., 2012	All
Climate change as mortality reminder	6 (10%)	Barth et al., 2018	S1 & S2
		Fritsche et al., 2012	All

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		Uhl et al., 2018	All
Climate change as nuclear threat	5 (8%)	Buttler et al., 2017	All
Envision self in nature; nature photos	4 (7%)	Selimbegović et al., 2016	All
		Koole & Van Den Berg, 2005	All
Green purchasing behavior	3 (5%)	Rahimah et al., 2018	All
		Rahimah et al., 2020	All
		Wang & Chao, 2020	All
Environmental norm	2 (3%)	Fritsche et al., 2010	S1 & S3
Explicit mortality within media on climate change	2 (3%)	Akil et al., 2018	All
		Mann & Wolfe, 2016	All
Climate change as end of world	2 (3%)	Lifshin et al., 2016	S4 & S5
Forest management game	2 (3%)	Fritsche et al., 2010	S2
		Kasser et al., 2000	S2
Materialism	2 (3%)	Kasser et al., 2000	All
Ecoguilt	1 (2%)	Harrison & Mallett, 2013	All
Pro-/Anti-bottled water	1 (2%)	Cote & Wolfe, 2017	All
Future generations	1 (2%)	Hu et al., 2018	All
Environmental hero project	1 (2%)	Ross & Wolfe, 2016	All
Environmental devastation	1 (2%)	Vess & Arndt, 2008	All

The most frequent environmental measure was of participants' environmental values or identity (n=20; 33%). Often this was used to examine mortality reminder influences on the psychological structure components of environmental identity and values. The second most common application was to present participants with a scenario describing climate change as a catastrophe (n=7; 12%). Slightly fewer studies (n=6; 10%) tested climate change explicitly as a mortality reminder and examined its influence on psychological structures. Finally, other studies considered implications of TMT hypotheses for understanding or modifying environmentally significant behaviors and consumer decisions.

While we found diverse environmental applications (16 types), these are far from exhaustive. The opportunities for further environmental research are discussed below.

4.0 DISCUSSION

Spanning two decades of published empirical research, our review identified 44 studies that used TMT methods to investigate environmental phenomenon as mortality reminders and how MS influences various environmentally relevant behaviors, values, and worldviews. While these studies demonstrated a range of possible TMT-environmental applications, there are many unexplored research opportunities to help resolve entrenched environmental issues.

[4.1 Systematic scoping review critiques and opportunities]

Research opportunities include study approach (e.g., quantitative vs. qualitative), design (e.g., control choice), and environmental applications.

[4.1.1 Opportunities for novel TMT research approaches]

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Most reviewed studies used quantitative designs. Quantitative TMT approaches allow researchers to test causal relationships between MS or psychological structures and environmental behaviors. Qualitative TMT research approaches are not discussed by Cox et al. (2019) and are generally absent from broader TMT literature. This absence does not mean qualitative methods are not useful. Qualitative approaches are designed to explore and understand – rather than prove – complex phenomenon in-situ (Cote et al., 2017), via valid, trustworthy, and credible methodology (Connelly, 2016). Such methods can be used to examine historical text or media to evaluate past environmental threat responses, providing valuable insights for policy and communication strategies.

As qualitative research methods are common in social sciences, relevant guidelines and examples are essential to increase TMT application. Qualitative research can be more flexible and speculative than quantitative (Maxwell, 2012) and better able to assess cultural elements (Corbin & Strauss, 2008). This flexibility and scope will be useful for novel TMT-environmental applications where new threats or defenses may be identified. The same arguments apply for mixed methods approaches—also lacking from TMT-environmental research—holding untapped potential to deeply explore relationships between mortality fears, defense responses, and environmental behaviors. We provide potential qualitative and mixed methods approaches in Section 4.2.

[4.1.2 Opportunities for consistency and comparability]

To generate strong conclusions from TMT-environment research, we must be able to compare results to those from other studies and replicate findings. For effective comparability, study components should be as consistent as possible. Within the quantitative studies reviewed, the majority used a dental pain control, which aligns with earlier TMT studies (Burke et al., 2010; Cox et al., 2019). However, over 50% of all reviewed studies used alternate control types, potentially decreasing comparability to other TMT studies and/or reducing replicability. For better comparability across TMT research, it may be wise to utilize the most common control. Replication concerns have gathered attention recently, particularly within social psychology (Bohannon, 2015; Schmidt & Oh, 2016). Considering the relatively small number of TMT-environmental studies (n=44) and the diverse range of environmental applications, reproducing studies using same or similar applications would potentially strengthen confidence in findings.

[4.1.3 Environmental applications]

We identified 16 unique environmental applications in our review (Table 6). This diversity is valuable because it offers a preliminary glimpse into TMT’s transferability. Most studies (n=20; 33%) used an environmental values or identity measure, often exploring MS influence on that measure. Some studies had participants envision climate change threat, at times with detailed prompts — rising sea levels from melting ice caps, food scarcity, droughts, floods (Uhl et al., 2018) — while others referred to climate change threats in near vs. future scenarios (e.g., 50 vs. 200 years from now; Lifshin et al., 2016). Due to the climate threat diversity, countless ways to contextualize nature, and multitude of environmental worldview measures, this research could powerfully inform behavioral change strategies and communication policies, whether at philanthropic or governmental levels.

[4.2 Designing environment/climate behavior studies using Terror Management Theory methods and insights]

Based on our assessment of existing TMT-environment literature, we developed a methodological framework to assist researchers new to TMT with their environmental-focused study design. First, we outline typical quantitative TMT designs according to the three core hypotheses and highlight where environmental concepts can be incorporated (Figures 4, 5, and 6). This is followed by example qualitative TMT-environmental study designs (Table 7). While several samples are provided, many more qualitative options are possible. We then present a non-exhaustive list of environmental concepts that warrant further study as potential psychological structures (Table 8) or mortality reminders (Table 9). These examples summarize and are in addition to the studies we reviewed in Tables 2 and 6, and Appendix B. Further detailed study approaches can be found by reviewing the

Please cite as: Smith, L., Ross, H., Shouldice, S. and Wolfe, S. (2022) “Mortality management and climate action: A review and reference for using Terror Management Theory methods in interdisciplinary environmental research.” *WIREs Climate Change*. <https://doi.org/10.1002/wcc.776> studies included in our scoping review. Our framework is intended to be a launching point and includes only a sample of applicable quantitative, qualitative, and mixed method approaches to explore the TMT-environment intersection, beyond standard quantitative designs^b.

[4.2.1. Quantitative TMT study design and environmental opportunities]

For quantitative research approaches, we outline different study designs for the randomized-control experimental survey method, the most frequently used in TMT studies (Cox et al., 2019). A fundamental primary consideration is whether to investigate proximal or distal defenses. Study design procedures must be carefully arranged to ensure conscious or unconscious death-thoughts are primed appropriately; mistakenly priming participants could compromise study integrity, potentially missing or accidentally inferring MS effects. In addition, not all TMT hypotheses are appropriate for examining both proximal and distal defenses. We present study procedures for each hypothesis and address defenses distinctly, clarifying necessary changes in each to access the intended defense. We further indicate what essential procedural elements (e.g., psychological structure measure; MS-threat manipulation) can be modified – indicated by bolded text and shading in figures – to explore environmental topics. These elements can be exchanged with environment-specific topics, for example, environmental identity or threatening environmental messaging. Tables 8 and 9 provide additional ideas for future TMT-environment research.

[4.2.1.1 Typical anxiety-buffer study design and environmental modifications]

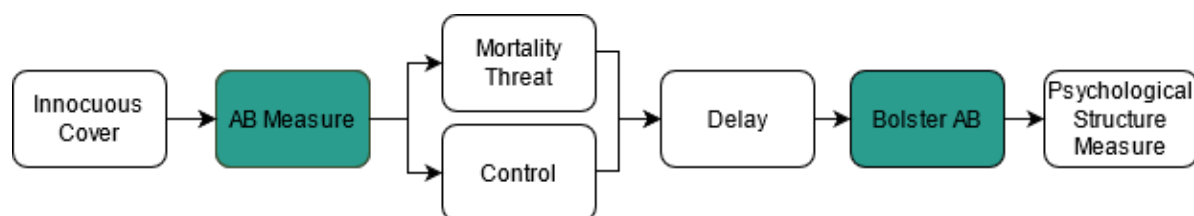
Box 2. If a *psychological structure* buffers anxiety, then bolstering that *psychological structure* should reduce anxiety when threatened with a mortality reminder.

AB hypothesis studies *reinforce* a psychological structure to determine whether it is effective at reducing anxiety, i.e., an individual’s need to distally defend against a mortality reminder. The AB hypothesis is only appropriate for investigating distal defenses because anxiety influences self-esteem, which is associated with distal defenses (Figure 1; Schimel et al., 2019). Distal defenses cannot be activated by explicit mortality reminders as proximal defenses would interfere with distal, anxiety-driven defenses.

An example experimental procedure for an AB hypothesis study is shown in Figure 4 (adapted from Cox et al., 2019; Florian et al., 2002).

Figure 4

Anxiety-Buffer Example Experimental Procedure. Shading Indicates Possible Environmental Modification



Organized as a questionnaire series, the typical experimental procedure begins with innocuous cover surveys to disguise the study’s true purpose. This deception is essential to avoid mistakenly mortality priming participants. Next, often included amongst cover surveys, an anxiety-buffer measure establishes participants’ baseline psychological structure state since what buffers anxiety for one may not for another (Cox et al., 2019; Florian et al., 2002). After establishing the AB baseline, half of the participants are exposed to a mortality-threat (e.g., PLAA) and the other half to a control or neutral-threat (e.g., watching TV; dental pain). Delay tasks (e.g., PANAS; word search) are often included to ensure distal defenses are engaged. However, if mortality-threat is implicit (e.g., “death” shown

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For environment-focused research modifications, the AB measure can be replaced with an environmental specific measure, as indicated by shading in Figure 4. For example, an environmental identity measure (e.g., Environmental Identity Scale; Clayton, 2003) could replace the AB measure and, following mortality manipulation, this identity could be strengthened. If environmental identity protects participants from death-anxieties, as other anxiety-buffers do, then reinforcing this identity following mortality reminders will result reduced psychological structure defense, compared to neutral or control groups. This modification has been exemplified in work by Mikulincer and Florian when determining that close relationships also serve as a mortality anxiety-buffer (Florian et al., 2002; Mikulincer et al., 2003). Future research to identify environmental anxiety-buffers would be worthwhile and could provide additional protection from mortality-anxieties.

[4.2.1.2. *Mortality Salience study design and environmental modifications*]

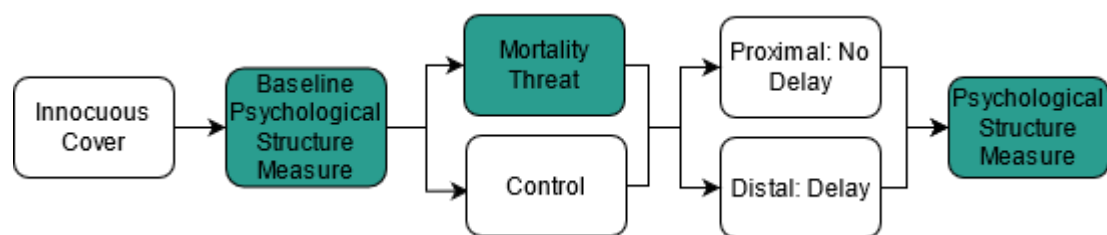
Box 3. If a **psychological structure** provides protection from death-thoughts, then **mortality reminders** should increase one's need for protection from these **psychological structures**.

Researchers can use the MS hypothesis to investigate the need for, and diverse range of, proximal and distal defenses in response to mortality reminders. Studies can also be structured to explore subjects that may act as mortality reminders and trigger MS effects.

An example MS experimental procedure is displayed in Figure 5.

Figure 5

Mortality Salience Typical Experimental Procedure. Shading Indicates Possible Environmental Modifications



Initial innocuous cover surveys disguise the study's true purpose, including or followed by a baseline psychological structure measure. This baseline measure establishes participants' values and/or worldviews. As these can vary from person to person, it is useful to measure these early to determine how they are (or are not) influenced by the subsequent MS induction. Mortality manipulation occurs next, making mortality salient for half the participants and exposing the remaining to a control (e.g., dental pain). There may be additional groupings, such as a neutral control or multiple alternative mortality threats, depending on the researchers' interests. A delay is used if distal defenses are being investigated and mortality reminder was explicit. No delay is used if proximal defenses are of interest or if mortality reminder was implicit. Finally, a second psychological structure measure determines MS influence on defenses of interest.

If the second psychological structure measure is higher than baseline, mortality was made salient and the structure investigated protects self-esteem. The latter may be of interest when examining novel psychological structures, such as environmental identity. If environmental identity protects self-

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esteem, then final structure measure will be higher for those that identify as environmental following MS exposure.

To apply environmental modifications to MS study design, two components can be replaced with environmental features. First, psychological structures could be replaced with environmentally relevant concepts, such as preference for well-manicured lawns, a cultural success symbol but environmentally damaging (Table 8 for more options). A second environmental modification could be replacing mortality threat with a climate or environmental threat, such as extreme drinking water shortages (Table 9 for more options). Alternatively, the environmental threat could be used in addition to the mortality threat, via an additional participant group. If the environmental threat is similarly threatening as typical mortality reminders (e.g., MAPS; PLAA), the final psychological structure measure will be higher than neutral or control groups. We recommend including both threat reminders, especially when the environmental threat has not previously been tested. Including both will ease comparison between variables and strengthen confidence in findings. Such findings could help map out the wide-range of environment-specific mortality reminders participants are subjected to on a regular basis.

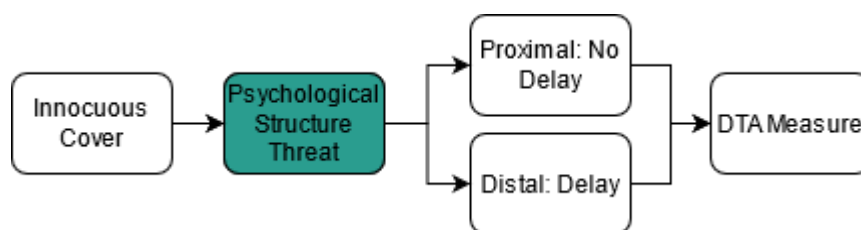
[4.2.1.3 Death-Thought Accessibility study design and environmental modifications]

Box 4. If a **psychological structure** provides protection from death-thoughts, then threatening the **psychological structure** should increase accessibility of death-related thoughts.

The DTA hypothesis is appropriate for both proximal and distal defenses because both defenses can be activated and measured via DTA, dependent on time between threat and measure and whether threat is implicit or explicit. The DTA hypothesis was useful in determining the role of delay, described above, in TMT's evolution. A typical DTA experimental procedure is displayed in Figure 6.

Figure 6

Death-Thought Accessibility Typical Experimental Procedure. Shading Indicates Possible Environmental Modifications



An innocuous cover is provided to disguise the study's mortality interest and avoid accidental priming. Psychological structure is then threatened to elicit death-thoughts subconsciously. Some studies may use traditional MS measures here, combining DTA and MS hypotheses. A delay is used next if distal defenses are of interest. Distal defenses can also be accessed without a delay with an implicit threat, as mentioned above. To access proximal defenses, no delay is needed. A DTA measure next determines if death-thoughts are present subconsciously. Typically, this measure is a word-fragment completion task or implicit association measure^c. If a psychological structure is threatened, DTA will be high after delay, due to activation of death-anxiety.

To modify DTA study design for TMT-environmental research, the psychological structure component can be replaced with an environmental feature, as indicated by shading in Figure 5. For example, researchers could threaten climate deniers' cultural identity by challenging their beliefs, or threaten climate activists by denying climate change, before measuring DTA after a delay. It must be noted that to threaten a participant's beliefs, it is necessary to know their beliefs. As such, it may be useful to include an early measure of participant identity/beliefs to know what threats may influence DTA,

Please cite as: Smith, L., Ross, H., Shouldice, S. and Wolfe, S. (2022) "Mortality management and climate action: A review and reference for using Terror Management Theory methods in interdisciplinary environmental research." *WIREs Climate Change*. <https://doi.org/10.1002/wcc.776> similar to suggestions made in Section 4.2.1.2. According to the DTA hypothesis, the intervention described here should increase DTA compared to a neutral or control group. Exploring DTA responses to environmental identity or belief threats would be interesting because it may result in the engagement of the distal defense system.

Quantitative study design examples were provided for the most direct application and environmental exploration of the TMT hypotheses but note that these hypotheses can be combined within one study, depending on what combination is best suited for the research question.

[4.2.2. Qualitative TMT study design and environmental opportunities]

In Table 7, we show how TMT concepts can be qualitatively tested. Example methods are provided as a starting point for researchers who seek to 1) analyze and interpret text, video, audio, photos/images, 2) observe people during or following a mortality-laden event, or 3) elicit information from diverse participants and groups. Each method is divided into proximal defenses, distal defenses, and mortality reminders as each TMT component requires distinct qualitative evaluations to identify evidence of their operation and understand their relationship to the environmental phenomena. Example studies demonstrate how these TMT components might be identified, observed, or measured.

Table 7

Example Non-exhaustive Qualitative Methods for Environment/Climate Terror Management Theory Research

Method	TMT Focus	Example Studies
<i>Analyze and interpret texts, video, audio, photos/images</i>		
Content analysis	Proximal defense	Analyze media for evidence of denial, distraction, and rationalization defenses in the context of the environmental phenomena of interest. <i>Example evidence:</i> Expressed climate change denial; described avoidance behaviors; opportunities for escapism; health appeals.
	Distal defense	Analyze media for evidence of distal defenses, selected based on the environmental phenomena of interest. <i>Example distal defense themes:</i> Worldview defense; identity reinforcement; out-group antagonism; self-esteem striving; hero projects. <i>Example evidence:</i> Emotional expression, e.g., pride or disgust; self-described behavior, e.g., consumption behaviors or bullying; expressed alignment with worldviews, e.g., "eco-friendly"; associations with local or national identities.
	Mortality reminder	Analyze media for explicit or implicit mortality reminders or evidence that death anxiety was experienced by viewers. <i>Example evidence:</i> Emotional expression (e.g., fear; worry or anxiety); "death" images or words; threatening health or environment related messages.
<i>Observe people in a particular time and place</i>		
Place and environment	Proximal defense	Observing environmentally relevant behaviors following death in different cultures.

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behavioral observation (e.g., mapping users)	Distal defense	Observing interactions and behaviors in situations where subtle or implied death reminders are present. For example, near a cemetery or at a climate rally.
	Mortality reminder	In the location, looking for evidence of mortality reminders, e.g., danger signs; climate awareness posters.
<i>Elicit information from individuals and groups</i>		
Interviews Focus groups	Proximal defense	Explore participants' experiences with, and responses to, environmental crises that resulted in others' injury and death. <i>Example evidence:</i> Climate change denial; adoption of new health habits; physical distancing from disaster site.
	Distal defense	Explore form and function of individual or collective distal defenses, e.g., hero-projects, self-esteem, and worldviews, by uncovering social norms, perceptions, or individual and group identities. <i>Example evidence:</i> Conveyed values; emotional expressions (e.g., pride or shame); experiences with bullying; consumption of explicitly local products.
	Mortality reminder	Explore evidence of mortality salience from experiences with negative environmental phenomena, e.g., extreme weather events. <i>Example evidence:</i> Use of "death" words or expression of negative emotions, e.g., fear or anxiety.

Researchers might choose to investigate individual components of the TMT framework—i.e., identifying evidence of proximal and distal defenses and mortality reminders—or multiple components can be integrated into a single study. Analysis would include assessing whether and how the evidence fits within the TMT framework, allowing researchers to theorize what findings reveal about death anxiety's influence on environmental phenomena. In this way, qualitative research can help identify potential TMT-environment connections that can be empirically tested.

[Insert Sidebar 2]

Researchers should consider diversity and intersectionality within their design because worldview threats and defenses may differ among various cultural groups and intersecting identities (e.g., Indigenous groups; Indigenous women; queer POC). While a feminist lens has been applied to some quantitative TMT work (Goldenberg & Roberts, 2004), there is ample scope for many rich and intersectional TMT investigations. Given diversity among opinions on what *is* environmental (e.g., geoengineering could be viewed positively or negatively), how intersectionality interacts with these environmental worldviews within a mortality-aware context would be an intriguing investigation.

On their own or combined within a single study, qualitative and quantitative methods can help uncover new and more effective approaches to addressing environmental behaviors.

[4.2.3 Imagining new research directions]

There are almost unlimited environmental concepts that could be integrated in future TMT research. These opportunities will allow environment-focused researchers to:

1. Characterize how environment or climate solutions can threaten or bolster psychological structures;
2. Identify behaviors that serve as proximal and distal defenses and under what circumstances those defenses may have negative or positive environmental outcomes; and
3. Determine which environmental scenarios act as mortality reminders.

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In the final two tables we provide environmental components that are alternatives to traditional TMT study features.

Table 8 describes potential environmental psychological structures, that is, potential mortality defense mechanisms that are environmental in nature. Further exploration of these structures can inform when and how these could be managed to reach desired environmental goals. Another approach might be testing whether intentional and targeted self-esteem or worldview bolstering would reduce counterproductive responses to death-related environmental threats.

Table 8

Research Concepts for Potential Environmental Psychological Structures

TMT Defense	Example Environmental Psychological Structures
Proximal	
Denial	<i>Climate Change Information Examples:</i> Actively disparage, discourage, or repress climate science information.
	<i>Residential Decision Examples:</i> Denial of personal risk to climate change and flooding risk, such as purchasing shoreline home or failing to adopt precautionary measures for flooding abatement.
Distraction	<i>Consumption Choice Examples:</i> Increased individual or household spending, including high carbon travel, inefficient vehicles, and status-signaling consumer products that are environmentally misaligned (e.g., wines from water scarce areas; animal products from endangered species; aquaculture fisheries); change in support for carbon tax/government subsidy for sustainable vs. unsustainable goods.
	<i>Information Examples:</i> Actively avoiding environment or climate-related news sources; producing or disseminating climate misinformation with the intention to distract and influence others.
Rationalization	<i>External Force Examples:</i> Belief that no individual or policy changes are necessary because technology and/or market forces and/or a higher power will "save" us.
	<i>'Them, Not Me' Examples:</i> Belief that climate change will only impact others who are distant, less fortunate, less savvy, 'not one of us', etc. As a result, our behavior changes are unnecessary.
	<i>Compromise Examples:</i> Belief that behavior or job title in one area negates the need for action in others, e.g., a biodiversity conservation officer who drives a large diesel truck; environmental activists and climate scientists who fly frequently to meetings or conferences.
Distal	
Worldview defense	<i>Identity Reinforcement Examples:</i> Communicate higher approval of those that engage in environmental behaviors (for participants who identify as environmentally inclined) in a vignette or through confederate praise.
	<i>Outgroup Antagonism Examples:</i> Communicating dislike of those that are polluting (for participants who identify as environmentally inclined); climate refugee stories and appraisal.

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Self-esteem striving	<i>Lifestyle Examples:</i> Diet-type (vegan vs. omnivore), transportation (passive vs. active), clothing (sustainable vs. fast-fashion).
	<i>Residential Examples:</i> Yard preferences (naturalized vs. manicured lawns), dwelling style and size (tiny home vs. rural off-grid vs. suburban mansions).
	<i>Environmental Hero Project Examples:</i> Construct large hydro-electric project; complete a PhD in environmental studies; named philanthropic donations to wildlife conservation.

The examples provided here relate to primarily individual research within a climate change context. We recognize that individual actions may be insufficient for effective CO₂ emissions reduction and that these actions may require substantial, systemic support (e.g., from governments). Considering how individual mortality defenses may aggregate and influence government, policy, and/or support for climate change initiatives will be an essential task and one which the authors encourage other scholars to tackle.

Table 9 provides a non-exhaustive compilation of potential environmental mortality reminders. Some have been used in prior research (e.g., hurricane and typhoon via Atalay & Meloy, 2020; urban flooding via Mann & Wolfe, 2016), but many environmental mortality reminder concepts remain untested. All possible reminders could be presented implicitly or explicitly within a climate change or environmental context. We propose these examples can be used as environmental threat conditions in MS hypothesis testing and included as possible mortality reminders within qualitative research.

Table 9

Potential Environmental Mortality Reminder Concepts

Category	Examples
Natural disaster	Flood, hurricane, typhoon, tsunami, tornado, heat wave, drought, wildfire, earthquake
Food	Malnutrition/starvation, crop loss
Water	Shortages, contamination
Air	Smog, acid rain
Energy	Nuclear disaster, hydroelectric dam breach
Biodiversity	Animal death, vegetation death, mass extinction event(s)
Environmental conflict	Resource scarcity
Creatureliness	Reproductive choices, "green burial" options, water reuse
Development	Loss of green space, pipelines

Environmental components may carry multi-level threats that are differentially distributed across geographic locations and population groups (Nash et al., 2017; Newell et al., 2014). For example, climate refugees may carry mortality reminders from climate change consequences in addition to self-esteem threats by threatening identity reinforcement with increased exposure to outgroups. Testing whether these threats are engaged could involve combining TMT hypotheses within a study, perhaps to isolate a defense of interest or to identify particular responses from specific groups (Cox et al., 2019). By combining TMT hypotheses, the complex relationship we have with mortality can be explored in detail and depth.

<SIDEBAR 1> Terror Management Theory Health Model (TMTHM): *Due to the interdisciplinary nature of climate change and environmental work, there are several research fields that may overlap*

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<SIDEBAR 2> Terror Management Theory and environmental behavior: Cote and Wolfe (2017) conducted a content analysis of bottled water advertisements and anti-bottled water communication campaign materials using a TMT framework to consider what the content revealed about why many Canadians drink bottled instead of tap water. Communication materials were examined and compared for evidence of proximal defenses (i.e., risk denial), distal defenses (i.e., self-esteem and worldview defense), and mortality reminders. The presence or absence of opportunities for the audience to manage their death anxiety via their drinking water selection offered unique insights about Canadians’ water consumption decisions and how tap water promotional efforts can be improved. To quantitatively extend these qualitative findings, a future study could be designed to test whether self-esteem, worldview defense, or risk denial messages in advertisements influence actual water consumption decisions when mortality is salient. In this way, qualitative research is useful for identifying how TMT relates to environmentally relevant phenomena and the relevant TMT hypotheses for further investigation. (155/250)

5. CONCLUSION

Our TMT-environmental research scoping review (2000-2020) is the first to summarize the research methods used to explore the intersection of mortality fears and environment-related phenomena. We found consistent delay use, variable control devices, a range of environmental conceptualizations, and significant opportunity for qualitative TMT research practices. We recommended further interdisciplinary research using TMT and environmental features to thoroughly test psychological defenses in response to environmental threats and to identify pro-environmental behavior patterns.

Based on our analysis of existing literature, we developed a practical framework to help extend TMT to environmental social-science research. For emerging or interdisciplinary scholars, the framework will be indispensable for its summary of TMT insights and methods. We outlined and recommended procedures for quantitative and qualitative approaches available to examine both proximal and distal defenses. Finally, we offered a non-exhaustive list of environmental themes to explore, and noted extensive opportunities exist given the complexities of socio-environmental systems.

An ambitious agenda of these interdisciplinary, potentially collaborative, TMT-scoped research opportunities will be essential as climate change’s intensifying, existential threat to the human species continues. Communicating this threat – and its solutions – involves explicit and implicit mortality reminders and the condemnation or rejection of – often dominant and entrenched – cultural worldviews. While some responses to these threats may include the reinforcement and proliferation of positive environmental behaviors and outcomes, the opposite is also true and remains very dangerous. As humans manage their mortality fears, they may defend existing behaviors that result in negative environmental outcomes, increase polarization towards outgroups, and even resort to identity-based violence. If we are to maximize positive environmental outcomes and minimize the latter scenarios, it is imperative that we develop a more nuanced appreciation of how humans manage existential threats within uncertain environmental contexts.

Extending TMT insights to climate change research will advance understanding of human responses to environmental mortality reminders. Knowledge of these responses will better inform and refine future climate communication strategies, particularly those efforts aimed at reluctant or resistant populations. Strategically and intentionally harnessing humans’ unique psychological capacities to

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manage death-thoughts within climate communications will help generate the sustained behavior changes needed for climate action.

Figures and Tables

Figure 1

Terror Management Theory's Psychological Defenses to Mortality Salience or Awareness (adapted from Wolfe & Tubi, 2018)

Figure 2

Extending key elements of Terror Management Theory to Three Avenues of Social-Environmental Research

Figure 3

Scoping Process Flow Diagram, Indicating Articles Included and Excluded, With Rationales

Figure 4

Anxiety-Buffer Example Experimental Procedure. Shading Indicates Where an Environmental Modification can be Applied

Figure 5

Mortality Salience Typical Experimental Procedure. Shading Indicates Where an Environmental Modification can be Applied

Figure 6

Death-Thought Accessibility Typical Experimental Procedure. Shading Indicates Where an Environmental Modification can be Applied

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Notes

^a For examples, see Conte et al., 1982.

^b See Cox et al., 2019 for a review of TMT quantitative methods.

^c See Cox et al., 2019, for a review.

Further Reading

1. Routledge, C., & Vess, M. (Eds.). (2019). *Handbook of Terror Management Theory*. Academic Press.
2. Greenberg, J., Koole, S. L., & Pyszczynski, T. A. (Eds.). (2004). *Handbook of experimental existential psychology*. Guilford Press
3. Intergovernmental Panel on Climate Change (2021). Summary for Policymakers. IPCC, 2021: Summary for Policymakers. In V. Masson-Delmotte, P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J. B. R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, & B. Zhou (Eds.), *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 1-41). Cambridge University Press. In Press.
https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM.pdf
4. Hein, C. J., Ten Hoeve, J. E., Gopalakrishnan, S., Livneh, B., Adams, H. D., Marino, E. K., & Susan Weiler, C. (2018). Overcoming early career barriers to interdisciplinary climate change research. *Wiley Interdisciplinary Reviews: Climate Change*, 9(5), 1–18.
<https://doi.org/10.1002/wcc.530>
5. Miller, C. H., & Massey, Z. B. (2020). Terror Management Theory Perspectives on Applied Communication Research. In H. D. O'Hair & M. J. O'Hair (Eds.), *The Handbook of Applied Communication Research* (pp. 417-442). John Wiley & Sons, Inc.
<https://doi.org/10.1002/9781119399926.ch25>

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References

- Abulof, U., Le Penne, S., & Pu, B. (2021). The pandemic politics of existential anxiety: Between steadfast resistance and flexible resilience. *International Political Science Review*, 42(3), 1-17. <https://doi.org/10.1177/01925121211002098>
- Adger, W., Barnett, J., Brown, K., Marshall, N., & O'Brien, K. (2013). Cultural dimensions of climate change impacts and adaptation. *Nature Climate Change*, 3, 112–117. <https://doi.org/10.1038/nclimate1666>
- Akil, H., Robert-Demontrond, P., & Bouillé, J. (2018). Exploitation of mortality salience in communication on climate change. *Recherche et Applications en Marketing*, 33(1), 2–29. <https://doi.org/10.1177/2051570717745839>
- Arndt, J., Routledge C. & Goldenberg, J. L. (2006). Predicting proximal health responses to reminders of death: The influence of coping style and health optimism, *Psychology & Health*, 21(5), 593-614. <https://doi.org/10.1080/14768320500537662>
- Arndt, J., Schimel, J., & Goldenberg, J. L. (2003). Death can be good for your health: Fitness intentions as a proximal and distal defense against mortality salience. *Journal of Applied Social Psychology*, 33(8), 1726–1746. <https://doi.org/10.1111/J.1559-1816.2003.TB01972.X>
- Arndt, J., & Solomon, S. (2003). The control of death and the death of control: The effects of mortality salience, neuroticism, and worldview threat on the desire for control. *Journal of Research in Personality*, 37(2), 1-22. [https://doi.org/10.1016/S0092-6566\(02\)00530-5](https://doi.org/10.1016/S0092-6566(02)00530-5)
- Arndt, J., Solomon, S., Kasser, T., & Sheldon, K. (2004). The urge to splurge: A terror management account of materialism and consumer behavior. *Journal of Consumer Psychology*, 14(3), 198-212. https://doi.org/10.1207/s15327663jcp1403_2
- Atalay, A. S., & Meloy, M. G. (2020). Improving evacuation compliance through control: Implications for emergency management policy and disaster communications. *Journal of Nonprofit and Public Sector Marketing*, 32(4), 364–378. <https://doi.org/10.1080/10495142.2020.1798855>
- Bamberg, S., & Möser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *Journal of Environmental Psychology*, 27(1), 14-25. <https://doi.org/10.1016/j.jenvp.2006.12.002>
- Barth, M., Masson, T., Fritsche, I., & Ziemer, C. T. (2018). Closing ranks: Ingroup norm conformity as a subtle response to threatening climate change. *Group Processes and Intergroup Relations*, 21(3), 497–512. <https://doi.org/10.1177/1368430217733119>

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- Bechtoldt, M. N., Göttsmann, A., Moslener, U., & Pauw, W. P. (2021). Addressing the climate change adaptation puzzle: A psychological science perspective. *Climate Policy*, 21(2), 186-202. <https://doi.org/10.1080/14693062.2020.1807897>
- Becker, E. (1973). *The denial of death*. Free Press.
- Bohannon, J. (2015). Many psychology papers fail replication test. *Science*, 349(6251), 910-911. <https://doi.org/10.1126/science.349.6251.910>
- Bowlby, J. (1969). *Attachment and loss* (Vol. 1). Basic Books.
- Brandt-Law, B., & Krauss, D. (2017). The effect of mortality salience on death penalty sentencing decisions when the defendant is severely mentally ill. *Journal of Aggression, Conflict and Peace Research*, 9(2), 141–154. <https://doi.org/10.1108/JACPR-04-2016-0225>
- Burke, B. L., Martens, A., & Faucher, E. H. (2010). Two decades of terror management theory: A meta-analysis of mortality salience research. *Personality and Social Psychology Review*, 14(2), 155-195. <https://doi.org/10.1177/1088868309352321>
- Buttlar, B., Latz, M., & Walther, E. (2017). Breaking bad: Existential threat decreases pro-environmental behavior. *Basic and Applied Social Psychology*, 39(3), 153–166. <https://doi.org/10.1080/01973533.2017.1296360>
- Clayton, S. (2003). Environmental identity: A conceptual and an operational definition. In S. Clayton & S. Opatow (Eds.), *Identity and the Natural Environment: The Psychological Significance of Nature* (pp. 45-65). MIT Press.
- Clayton, S., Devine-Wright, P., Stern, P. C., Whitmarsh, L., Carrico, A., Steg, L., Swim, J., & Bonnes, M. (2015). Psychological research and global climate change. *Nature Climate Change*, 5(7), 640–646. <https://doi.org/10.1038/nclimate2622>
- Cohen, F., Solomon, S., & Kaplin, D. (2017). You're hired! Mortality salience increases Americans' support for Donald Trump. *Analyses of Social Issues and Public Policy*, 17(1), 339-357. <https://doi.org/10.1111/asap.12143>
- Connelly, L. (2016). Trustworthiness in qualitative research. *MedSurg Nursing*, 25(6), 435-436.
- Conte, H. R., Weiner, M. B., & Plutchik, R. (1982). Measuring death anxiety: Conceptual, psychometric, and factor-analytic aspects. *Journal of Personality and Social Psychology*, 43(4), 775–785. <https://doi.org/10.1037//0022-3514.43.4.775>
- Corbin, J., & Strauss, A. (2008). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (3rd ed.). SAGE Publications, Inc. <https://doi.org/10.4135/9781452230153>
- Cote, S. A., Ross, H. C., David, K., & Wolfe, S. E. (2017). Walkerton revisited: How our psychological defenses may influence responses to water crises. *Ecology and Society*, 22(3), Article 32. <https://doi.org/10.5751/ES-09616-220332>
- Cote, S., & Wolfe, S. E. (2017). Evidence of mortality salience and psychological defenses in bottled water campaigns. *Applied Environmental Education and Communication*, 17(4), 281–298. <https://doi.org/10.1080/1533015X.2017.1399836>

- Please cite as:** Smith, L., Ross, H., Shouldice, S. and Wolfe, S. (2022) "Mortality management and climate action: A review and reference for using Terror Management Theory methods in interdisciplinary environmental research." *WIREs Climate Change*. <https://doi.org/10.1002/wcc.776>
- Courtney, E. P., Goldenberg, J., & Boyd, P. (2020). The contagion of mortality: A terror management health model for pandemics. *British Journal of Social Psychology*, 59(3), 607-617. <https://doi.org/10.1111/bjso.12392>
- Cox, C. R., & Arndt, J. (2012). How sweet it is to be loved by you: The role of perceived regard in the terror management of close relationships. *Journal of Personality and Social Psychology*, 102(3), 616-632. <http://doi.org/10.1037/a0025947>
- Cox, C. R., Darrell, A., & Arrowood, R. B. (2019). The method behind the science: A guide to conducting terror management theory research. In C. Routledge, & M. Vess (Eds.), *Handbook of terror management theory* (pp. 85–132). Academic Press. <https://doi.org/10.1016/B978-0-12-811844-3.00004-4>
- Cunsolo, A., & Ellis, N. R. (2018). Ecological grief as a mental health response to climate change-related loss. *Nature Climate Change*, 8(4), 275–281. <https://doi.org/10.1038/s41558-018-0092-2>
- Dickinson, J. L. (2009). The people paradox: Self-esteem striving, immortality ideologies, and human response to climate change. *Ecology and Society*, 14(1), Article 34. <http://www.ecologyandsociety.org/vol14/iss1/art34/>
- Dor-Ziderman, Y., Lutz, A., & Goldstein, A. (2019). Prediction-based neural mechanisms for shielding the self from existential threat. *NeuroImage*, 202, 116080. <https://doi.org/10.1016/j.neuroimage.2019.116080>
- Fairlamb, S., & Cinnirella, M. (2020). To be or not to be tolerant? A Terror Management perspective exploring the ideological dilemma of tolerance and prejudice. *British Journal of Social Psychology*, 60(2), 360-382. <https://doi.org/10.1111/bjso.12407>
- Florian, V., Mikulincer, M., & Hirschberger, G. (2002). The anxiety-buffering function of close relationships: Evidence that relationship commitment acts as a terror management mechanism. *Journal of Personality and Social Psychology*, 82(4), 527-542. <https://doi.org/10.1037/0022-3514.82.4.527>
- Fritsche, I., Cohrs, J. C., Kessler, T., & Bauer, J. (2012). Global warming is breeding social conflict: The subtle impact of climate change threat on authoritarian tendencies. *Journal of Environmental Psychology*, 32(1), 1–10. <https://doi.org/10.1016/j.jenvp.2011.10.002>
- Fritsche, I., & Häfner, K. (2012). The malicious effects of existential threat on motivation to protect the natural environment and the role of environmental identity as a moderator. *Environment and Behavior*, 44(4), 570–590. <https://doi.org/10.1177/0013916510397759>
- Fritsche, I., Jonas, E., Kayser, D. N., & Koranyi, N. (2010). Existential threat and compliance with pro-environmental norms. *Journal of Environmental Psychology*, 30(1), 67–79. <https://doi.org/10.1016/j.jenvp.2009.08.007>
- Gifford, R. (2011). The dragons of inaction: Psychological barriers that limit climate change mitigation and adaptation. *American Psychologist*, 66(4), 290–302. <https://doi.org/10.1037/a0023566>

- Please cite as:** Smith, L., Ross, H., Shouldice, S. and Wolfe, S. (2022) "Mortality management and climate action: A review and reference for using Terror Management Theory methods in interdisciplinary environmental research." *WIREs Climate Change*. <https://doi.org/10.1002/wcc.776>
- Goldenberg, J. L., & Arndt, J. (2008). The implications of death for health: A terror management health model for behavioral health promotion. *Psychological Review*, 115(4), 1032–1053. <https://doi.org/10.1037/a0013326>
- Goldenberg, J. L., Pyszczynski, T., Greenberg, J., Solomon, S., Kluck, B., & Cornwell, R. (2001). I am not an animal: Mortality salience, disgust, and the denial of human creatureliness. *Journal of Experimental Psychology: General*, 130(3), 427-435. <https://doi.org/10.1037//0096-3445.130.3.427>
- Goldenberg, J. L., & Roberts, T. A. (2004). The beast within the beauty: An existential perspective on the objectification and condemnation of women. In J. Greenberg, S. L., Koole, and T. Pyszczynski (Eds.), *Handbook of experimental existential psychology* (pp.71-85). Guilford.
- Greenberg, J., Pyszczynski, T., & Solomon, S. (1986). The causes and consequences of a need for self-esteem: A terror management theory. In R. F. Baumeister (Ed.), *Public self and private self* (pp. 189–212). Springer-Verlag.
- Greenberg, J., Pyszczynski, T., Solomon, S., Pinel, E., Simon, L., & Jordan, K. (1993). Effects of self-esteem on vulnerability-denying defensive distortions: Further evidence of an anxiety-buffering function of self-esteem. *Journal of Experimental Social Psychology*, 29(3), 229-251. <https://doi.org/10.1006/jesp.1993.1010>
- Greenberg, J., Pyszczynski, T., Solomon, S., Rosenblatt, A., Veeder, M., Kirkland, S., & Lyon, D. (1990). Evidence for terror management theory II: The effects of mortality salience on reactions to those who threaten or bolster the cultural worldview. *Journal of Personality and Social Psychology*, 58(2), 308-318. <https://doi.org/10.1037/0022-3514.58.2.308>
- Greenberg, J., Simon, L., Pyszczynski, T., Solomon, S., & Chatel, D. (1992). Terror management and tolerance: Does mortality salience always intensify negative reactions to others who threaten one's worldview? *Journal of Personality and Social Psychology*, 63(2), 212-220. <https://doi.org/10.1037/0022-3514.63.2.212>
- Harmon-Jones, E., Simon, L., Greenberg, J., Pyszczynski, T., Solomon, S., & McGregor, H. (1997). Terror management theory and self-esteem: Evidence that increased self-esteem reduced mortality salience effects. *Journal of Personality and Social Psychology*, 72(1), 24-36. <https://doi.org/10.1037/0022-3514.72.1.24>
- Harrison, P. R., & Mallett, R. K. (2013). Mortality salience motivates the defense of environmental values and increases collective ecoguilt. *Ecopsychology*, 5(1), 36–43. <https://doi.org/10.1089/eco.2012.0070>
- Hart, J., Shaver, P. R., & Goldenberg, J. L. (2005). Attachment, self-esteem, worldviews, and terror management: evidence for a tripartite security system. *Journal of Personality and Social Psychology*, 88(6), 999-1013. <https://doi.org/10.1037/0022-3514.88.6.999>
- Harvell, L. A., & Nisbett, G. S. (2016). *Denying death: An interdisciplinary approach to terror management theory*. Routledge.

- Please cite as:** Smith, L., Ross, H., Shouldice, S. and Wolfe, S. (2022) "Mortality management and climate action: A review and reference for using Terror Management Theory methods in interdisciplinary environmental research." *WIREs Climate Change*. <https://doi.org/10.1002/wcc.776>
- Hauer, M. E., & Santos-Lozada, A. R. (2021). Inaction on climate change projected to reduce European life expectancy. *Population Research and Policy Review*, 40, 629-638. <https://doi.org/10.1007/s11113-020-09584-w>
- Hayes, J., Schimel, J., Arndt, J., & Faucher, E. H. (2010). A theoretical and empirical review of the death-thought accessibility concept in terror management research. *Psychological Bulletin*, 136(5), 699–739. <https://doi.org/10.1037/a0020524>
- Ho, E. H., Budescu, D., & Por, H. H. (2017). Psychological challenges in communicating about climate change and its uncertainties. *Oxford Encyclopedia for Climate Change Communication*. <https://doi.org/10.1093/acrefore/9780190228620.013.381>
- Hornsey, M. J., & Fielding, K. S. (2020). Understanding (and reducing) inaction on climate change. *Social Issues and Policy Review*, 14(1), 3-35. <https://doi.org/10.1111/sipr.12058>
- Hornsey, M. J., Harris, E. A., Bain, P. G., & Fielding, K. S. (2016). Meta-analyses of the determinants and outcomes of belief in climate change. *Nature Climate Change*, 6(6), 622-626. <https://doi.org/10.1038/NCLIMATE2943>
- Hu, S., Zheng, X., Zhang, N., & Zhu, J. (2018). The impact of mortality salience on intergenerational altruism and the perceived importance of Sustainable Development Goals. *Frontiers in Psychology*, 9, Article 1399. <https://doi.org/10.3389/fpsyg.2018.01399>
- Hulme, M. (2009). *Why we disagree about climate change: Understanding controversy, inaction, and opportunity*. Cambridge University Press. <https://doi.org/10.1017/CBO9780511841200>
- Jonas, E., & Fischer, P. (2006). Terror management and religion: Evidence that intrinsic religiousness mitigates worldview defense following mortality salience. *Journal of Personality and Social Psychology*, 91(3), 553-567. <https://doi.org/10.1037/0022-3514.91.3.553>
- Juhl, J., & Routledge, C. (2016). Putting the terror in terror management theory: Evidence that the awareness of death does cause anxiety and undermine psychological well-being. *Current Directions in Psychological Science*, 25(2), 99-103. <https://doi.org/10.1177/0963721415625218>
- Kasser, T., & Sheldon, K. M. (2000). Of wealth and death: Materialism, mortality salience, and consumption behavior. *Psychological Science*, 11(4), 348–351. <https://doi.org/10.1111/1467-9280.00269>
- Klößner, C. A. (2013). A comprehensive model of the psychology of environmental behaviour-A meta-analysis. *Global Environmental Change-Human and Policy Dimensions*, 23(5), 1028-1038. <https://doi.org/10.1016/j.gloenvcha.2013.05.014>
- Koç, V. & Kafa, G. (2019). The roles of self-esteem and attachment within the framework of terror management theory. *Current Approaches in Psychiatry*, 11(1), 129-139. <https://doi.org/10.18863/pgy.419330>
- Koole, S. L., & Van Den Berg, A. E. (2005). Lost in the wilderness: Terror management, action orientation, and nature evaluation. *Journal of Personality and Social Psychology*, 88(6), 1014–1028. <https://doi.org/10.1037/0022-3514.88.6.1014>

- Please cite as:** Smith, L., Ross, H., Shouldice, S. and Wolfe, S. (2022) "Mortality management and climate action: A review and reference for using Terror Management Theory methods in interdisciplinary environmental research." *WIREs Climate Change*. <https://doi.org/10.1002/wcc.776>
- Landau, M. J., Solomon, S., Greenberg, J., Cohen, F., Pyszczynski, T., Arndt, J., C. Miller, C., Ogilvie, D. M., & Cook, A. (2004). Deliver us from evil: The effects of mortality salience and reminders of 9/11 on support for President George W. Bush. *Personality and Social Psychology Bulletin*, 30(9), 1136-1150. <https://doi.org/10.1177/0146167204267988>
- Lede, E., & Meleady, R. (2018). Applying social influence insights to encourage climate resilient domestic water behavior: Bridging the theory-practice gap. *WIREs Climate Change*, 10(1), Article e562. <https://doi.org/10.1002/wcc.562>
- Lifshin, U., Greenberg, J., Weise, D., & Soenke, M. (2016). It's the end of the world and I feel fine: Soul belief and perceptions of end-of-the-world scenarios. *Personality and Social Psychology Bulletin*, 42(1), 104–117. <https://doi.org/10.1177/0146167215616800>
- Lloyd, S. J., Kovats, R. S., Chalabi, Z., Brown, S., & Nicholls, R. J. (2016). Modelling the influences of climate change-associated sea-level rise and socioeconomic development on future storm surge mortality. *Climatic Change*, 134(3), 441–455. <https://doi.org/10.1007/s10584-015-1376-4>
- Lockwood, C., dos Santos, K. B., & Pap, R. (2019). Practical guidance for knowledge synthesis: Scoping review methods. *Asian Nursing Research*, 13(5), 287-294. <https://doi.org/10.1016/j.anr.2019.11.002>
- Mann, C., & Wolfe, S. E. (2016). Risk perceptions and terror management theory: Assessing public responses to urban flooding in Toronto, Canada. *Water Resources Management*, 30(8), 2651–2670. <https://doi.org/10.1007/s11269-016-1308-8>
- Markowitz, E. M., & Guckian, M. L. (2018). Climate change communication: Challenges, insights, and opportunities. In Clayton, S. & Manning, C. (Eds.), *Psychology and climate change* (pp. 35-63). Elsevier. <https://doi.org/10.1016/B978-0-12-813130-5.00003-5>
- Martin, C., Doyle, J., LaFrance, J., Lefthand, M. J., Young, S. L., Three Irons, E., & Eggers, M. J. (2020). Change rippling through our waters and culture. *Journal of Contemporary Water Research & Education*, 169(1), 61–78. <https://doi.org/10.1111/j.1936-704x.2020.03332.x>
- Maxwell, J. A. (2012). *Qualitative research design: An interactive approach*. SAGE Publications, Inc.
- McCarthy, J., Chen, C., López-Carr, D., Louise, B., & Walker, E. (2014). Socio-cultural dimensions of climate change: Charting the terrain. *GeoJournal*, 79, 665–675. <https://doi.org/10.1007/s10708-014-9546-x>
- Merkel, S. H., Person, A. M., Peppler, R. A., & Melcher, S. M. (2020). Climate change communication: Examining the social and cognitive barriers to productive environmental communication. *Social Science Quarterly*, 101(5), 2085-2100. <https://doi.org/10.1111/ssqu.12843>
- Mikulincer, M., Florian, V., Birnbaum, G., & Malishkevich, S. (2002). The death-anxiety buffering function of close relationships: Exploring the effects of separation reminders on death-thought accessibility. *Personality and Social Psychology Bulletin*, 28(3), 287–299. <https://doi.org/10.1177/0146167202286001>

- Please cite as:** Smith, L., Ross, H., Shouldice, S. and Wolfe, S. (2022) "Mortality management and climate action: A review and reference for using Terror Management Theory methods in interdisciplinary environmental research." *WIREs Climate Change*. <https://doi.org/10.1002/wcc.776>
- Mikulincer, M., Florian, V., & Hirschberger, G. (2003). The existential function of close relationships: Introducing death into the science of love. *Personality and Social Psychology Review*, 7(1), 20-40. https://doi.org/10.1207/S15327957PSPR0701_2
- Moher, D., Liberati, A., Tetzlaff, J., & Altman, D.G. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *BMJ*, 370, Article m2632. <https://doi.org/10.1136/bmj.b2535>
- Moser, S. C. (2016). Reflections on climate change communication research and practice in the second decade of the 21st century: What more is there to say? *Wiley Interdisciplinary Reviews: Climate Change*, 7(3), 345–369. <https://doi.org/10.1002/wcc.403>
- Nash, N., Whitmarsh, L., Capstick, S., Hargreaves, T., Poortinga, W., Thomas, G., Sautkina, E., & Xenias, D. (2017). Climate-relevant behavioral spillover and the potential contribution of social practice theory. *WIREs Climate Change*, 8(6), Article e481. <https://doi.org/10.1002/wcc.481>
- Newell, B. R., McDonald, R. I., Brewer, M., & Hayes, B. K. (2014). The psychology of environmental decisions. *Annual Review of Environment and Resources*, 39(1), 443-467. <https://doi.org/10.1146/annurev-environ-010713-094623>
- Nielsen, K. S., Clayton, S., Stern, P. C., Dietz, T., Capstick, S., & Whitmarsh, L. (2020). How psychology can help limit climate change. *American Psychologist*, 76(1), 130-144. <https://doi.org/10.1037/amp0000624>
- Nordås, R., & Gleditsch, N. P. (2015). Climate change and conflict. In S. Hartard, & W. Liebert (Eds.), *Competition and conflicts on resource use* (pp. 21–38). Springer International Publishing. https://doi.org/10.1007/978-3-319-10954-1_3
- O'Brien, K. L., & Wolf, J. (2010). A values-based approach to vulnerability and adaptation to climate change. *WIREs Climate Change*, 1(2), 232-242. <https://doi.org/10.1002/wcc.30>
- Osbaldiston, R., & Schott, J. (2012). Environmental sustainability and behavioral science: Meta-analysis of pro-environmental behavior experiments. *Environment and Behavior*, 44(2), 257-299. <https://doi.org/10.1177/0013916511402673>
- Palinkas, L. A., & Wong, M. (2020). Global climate change and mental health. *Current Opinion in Psychology*, 32, 12–16. <https://doi.org/10.1016/j.copsyc.2019.06.023>
- Palm, R., Bolsen, T., & Kingsland, J. T. (2020). "Don't tell me what to do": Resistance to climate change messages suggesting behavior change. *Weather, Climate, and Society*, 12(4), 827-835. <https://doi.org/10.1175/WCAS-D-19-0141.1>
- Panu, P. (2020). Anxiety and the ecological crisis: An analysis of eco-anxiety and climate anxiety. *Sustainability*, 12(19), Article 7836. <https://doi.org/10.3390/SU12197836>
- Phalkey, R. K., Aranda-Jan, C., Marx, S., Höfle, B., & Sauerborn, R. (2015). Systematic review of current efforts to quantify the impacts of climate change on undernutrition. *Proceedings of the National Academy of Sciences*, 112(33), E4522-E4529. <https://doi.org/10.1073/pnas.1409769112>

- Please cite as:** Smith, L., Ross, H., Shouldice, S. and Wolfe, S. (2022) "Mortality management and climate action: A review and reference for using Terror Management Theory methods in interdisciplinary environmental research." *WIREs Climate Change*. <https://doi.org/10.1002/wcc.776>
- Pyszczynski, T., Greenberg, J., & Solomon, S. (1999). A dual-process model of defense against conscious and unconscious death-related thoughts: An extension of terror management theory. *Psychological Review*, *106*(4), 835-845. <https://doi.org/10.1037/0033-295X.106.4.835>
- Pyszczynski, T., Greenberg, J., Solomon, S., Arndt, J., & Schimel, J. (2004). Why do people need self-esteem? A theoretical and empirical review. *Psychological Bulletin*, *130*(3), 435–468. <https://doi.org/10.1037/0033-2909.130.3.435>
- Pyszczynski, T., Lockett, M., Greenberg, J., & Solomon, S. (2021). Terror management theory and the COVID-19 Pandemic. *Journal of Humanistic Psychology*, *61*(2), 173–189. <https://doi.org/10.1177/0022167820959488>
- Pyszczynski, T., Motyl, M., Vail, K. E., Hirschberger, G., Arndt, J., & Kesebir, P. (2012). Drawing attention to global climate change decreases support for war. *Peace and Conflict*, *18*(4), 354–368. <https://doi.org/10.1037/a0030328>
- Pyszczynski, T., Solomon, S., & Greenberg, J. (2015). Thirty years of terror management theory: From genesis to revelation. In J. M. Olson, & M. P. Zanna (Eds.), *Advances in experimental social psychology* (Vol. 52, pp. 1-70). Academic Press. <https://doi.org/10.1016/bs.aesp.2015.03.001>
- Rahimah, A., Khalil, S., Cheng, J. M. S., Tran, M. D., & Panwar, V. (2018). Understanding green purchase behavior through death anxiety and individual social responsibility: Mastery as a moderator. *Journal of Consumer Behaviour*, *17*(5), 477–490. <https://doi.org/10.1002/cb.1733>
- Rahimah, A., Khalil, S., Dang, H. P., & Cheng, J. M. S. (2020). The terror of death and consumers' sustainability attitudes. *Journal of Retailing and Consumer Services*, *57*, Article 102196. <https://doi.org/10.1016/j.jretconser.2020.102196>
- Reser, J. P., & Bradley, G. L. (2020). The nature, significance, and influence of perceived personal experience of climate change. *WIREs Climate Change*, *11*(5), Article e668. <https://doi.org/10.1002/wcc.668>
- Rosenblatt, A., Greenberg, J., Solomon, S., Pyszczynski, T., & Lyon, D. (1989). Evidence for terror management theory: I. The effects of mortality salience on reactions to those who violate or uphold cultural values. *Journal of Personality and Social Psychology*, *57*(4), 681-690. <https://doi.org/10.1037/0022-3514.57.4.681>
- Ross, H. C., & Wolfe, S. E. (2016). Life after death: Evidence of the Hoover Dam as a hero project that defends against mortality reminders. *Water History*, *8*(1), 3-21. <https://doi.org/10.1007/s12685-015-0151-9>
- Routledge, C., & Vess, M. Eds. (2019). *Handbook of terror management theory*. Academic Press. <https://doi.org/10.1016/C2016-0-02231-3>
- Santamouris, M. (2020). Recent progress on urban overheating and heat island research. Integrated assessment of the energy, environmental, vulnerability and health impact. Synergies with the global climate change. *Energy & Buildings*, *207*, Article 109482. <https://doi.org/10.1016/j.enbuild.2019.109482>

- Please cite as:** Smith, L., Ross, H., Shouldice, S. and Wolfe, S. (2022) "Mortality management and climate action: A review and reference for using Terror Management Theory methods in interdisciplinary environmental research." *WIREs Climate Change*. <https://doi.org/10.1002/wcc.776>
- Schewe, J., Gosling, S. N., Reyer, C., Zhao, F., Ciais, P., Elliott, J., Francois, L., Huber, V., Lotze, H. K., Seneviratne, S. I., van Vliet, M. T. H., Vautard, R., Wada, Y., Breuer, L., Büchner, M., Carozza, D. A., Chang, J., Coll, M., Deryng, D., ... Warszawski, L. (2019). State-of-the-art global models underestimate impacts from climate extremes. *Nature Communications*, 10(1). Article 1005. <https://doi.org/10.1038/s41467-019-08745-6>
- Schilling, J., Hertig, E., Trambly, Y., & Scheffran, J. (2020). Climate change vulnerability, water resources and social implications in North Africa. *Regional Environmental Change*, 20, Article 15. <https://doi.org/10.1007/s10113-020-01597-7>
- Schimel, J., Hayes, J., & Sharp, M. (2019). A consideration of three critical hypotheses. In C. Routledge & M. Vess (Eds.), *Handbook of terror management theory* (pp. 1–30). Elsevier. <https://doi.org/10.1016/B978-0-12-811844-3.00001-9>
- Schimel, J., Hayes, J., Williams, T., & Jahrig, J. (2007). Is death really the worm at the core? Converging evidence that worldview threat increases death-thought accessibility. *Journal of Personality and Social Psychology*, 92(5), 789–803. <https://doi.org/10.1037/0022-3514.92.5.789>
- Schmeichel, B. J., & Martens, A. (2005). Self-affirmation and mortality salience: affirming values reduces worldview defense and death-thought accessibility. *Personality & Social Psychology Bulletin*, 31(5), 658–667. <https://doi.org/10.1177/0146167204271567>
- Schmidt, A., Ivanova, A., & Schäfer, M. S. (2013). Media attention for climate change around the world: A comparative analysis of newspaper coverage in 27 countries. *Global Environmental Change*, 23(5), 1233–1248. <https://doi.org/10.1016/j.gloenvcha.2013.07.020>
- Schmidt, F. L., & Oh, I.-S. (2016). The crisis of confidence in research findings in psychology: Is lack of replication the real problem? Or is it something else? *Archives of Scientific Psychology*, 4(1), 32-37. <https://doi.org/10.1037/arc0000029>
- Selimbegović, L., Chatard, A., Er-Rafiy, A., & Pyszczynski, T. (2016). Nuclear accident reminders and support for nuclear energy: Paradoxical effect. *Journal of Environmental Psychology*, 48, 87–100. <https://doi.org/10.1016/j.jenvp.2016.09.004>
- Sharman, A., & Perkins, R. (2017). Post-decisional logics of inaction: The influence of knowledge controversy in climate policy decision-making. *Environment and Planning*, 49(10), 2281-2299. <https://doi.org/10.1177/0308518X17722786>
- Shindell, D., Zhang, Y., Scott, M., Ru, M., Stark, K., & Ebi, K. L. (2020). The effects of heat exposure on human mortality throughout the United States. *GeoHealth*, 4(4), Article e2019GH000234. <https://doi.org/10.1029/2019GH000234>
- Silva, R. A., West, J. J., Lamarque, J. F., Shindell, D. T., Collins, W. J., Faluvegi, G., Folberth, G. A., Horowitz, L. W., Nagashima, T., Naik, V., Rumbold, S. T., Sudo, K., Takemura, T., Bergmann, D., Cameron-Smith, P., Doherty, R. M., Josse, B., MacKenzie, I. A., Stevenson, D. S., & Zeng, G. (2017). Future global mortality from changes in air pollution attributable to climate change. *Nature Climate Change*, 7(9), 647–651. <https://doi.org/10.1038/nclimate3354>

- Please cite as:** Smith, L., Ross, H., Shouldice, S. and Wolfe, S. (2022) "Mortality management and climate action: A review and reference for using Terror Management Theory methods in interdisciplinary environmental research." *WIREs Climate Change*. <https://doi.org/10.1002/wcc.776>
- Solomon, S. (2021). A brief history of death. In N. Dess (Ed.) *A multidisciplinary approach to embodiment: Understanding human being* (pp. 27-32). Routledge Focus.
- Solomon, S., Greenberg, J., & Pyszczynski, T. (1991). A terror management theory of social behavior: The psychological functions of self-esteem and cultural worldviews. *Advances in Experimental Social Psychology*, 24, 93-159. [https://doi.org/10.1016/S0065-2601\(08\)60328-7](https://doi.org/10.1016/S0065-2601(08)60328-7)
- Stankuniene, G., Streimikiene, D., & Kyriakopoulos, G. L. (2020). Systematic literature review on behavioral barriers of climate change mitigation in households. *Sustainability*, 12(7369), 1-18. <https://doi.org/10.3390/su12187369>
- Strauss, S. (2012). Are cultures endangered by climate change? Yes, but.... *Wiley Interdisciplinary Reviews: Climate Change*, 3(4), 371–377. <https://doi.org/10.1002/wcc.181>
- Swanson, T. J., & Landau, M. J. (2019). Terror management motivation fuels structure-seeking. In C. Routledge, & M. Vess (Eds.), *Handbook of terror management theory* (pp. 113 – 156), Academic Press. <https://doi.org/10.1016/B978-0-12-811844-3.00005-6>
- Swim, J., Clayton, S., Doherty, T., Gifford, R., Howard, G., Reser, J., Sern, P., & Weber, E. (2009). Psychology and global climate change: Addressing a multi-faceted phenomenon and set of challenges. A report by the American Psychological Association's task force on the interface between psychology and global climate change. *American Psychologist*, 66(4), 241-250. <https://doi.org/10.1037/a0023220>
- Tschakert, P., Barnett, J., Ellis, N., Lawrence, C., Tuana, N., New, M., Elrick-Barr, C., Pandit, R., & Pannell, D. (2017). Climate change and loss, as if people mattered: Values, places, and experiences. *WIREs Climate Change*, 8(5), Article e476. <https://doi.org/10.1002/wcc.476>
- Tschakert, P., Ellis, N.R., Anderson, C., Kelly, A., & Obeng, J. (2019). One thousand ways to experience loss: A systematic analysis of climate-related intangible harm from around the world. *Global Environmental Change*, 55, 58-72. <https://doi.org/10.1016/j.gloenvcha.2018.11.006>
- Uhl, I., Klackl, J., Hansen, N., & Jonas, E. (2018). Undesirable effects of threatening climate change information: A cross-cultural study. *Group Processes and Intergroup Relations*, 21(3), 513-529. <https://doi.org/10.1177/1368430217735577>
- Vail, K. E., Courtney, E., & Arndt, J. (2019). The influence of existential threat and tolerance salience on anti-Islamic attitudes in American politics, *Political Psychology*, 40(5), 1143-1162. <https://doi.org/10.1111/pops.12579>
- Vail, E. K., & Juhl, J. (2015). An appreciative view of the brighter side of terror management processes. *Social Sciences*, 4(4), 1020-1045. <https://doi.org/10.3390/socsci4041020>
- Van Kessel, C. (2020). Teaching the climate crisis: Existential considerations. *Journal of Curriculum Studies Research*, 2(1), 129-145. <https://doi.org/10.46303/jcsr.02.01.8>
- Vesco, P., Dasgupta, S., De Cian, E., & Carraro, C. (2020). Natural resources and conflict: A meta-analysis of the empirical literature. *Ecological Economics*, 172, Article 106633. <https://doi.org/10.1016/j.ecolecon.2020.106633>

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- Vess, M., & Arndt, J. (2008). The nature of death and the death of nature: The impact of mortality salience on environmental concern. *Journal of Research in Personality*, 42(5), 1376–1380. <https://doi.org/10.1016/j.jrp.2008.04.007>
- Vess, M., Arndt, J., & Cox, C. R. (2012). Faith and nature: The effect of death-relevant cognitions on the relationship between religious fundamentalism and connectedness to nature. *Social Psychological and Personality Science*, 3(3), 333–340. <https://doi.org/10.1177/1948550611420303>
- Wang, X., & Chao, C. H. (2020). Nostalgia decreases green consumption: The mediating role of past orientation. *Business Research Quarterly*, 23(4), 270–284. <https://doi.org/10.1177/2340944420966867>
- Whitmarsh, L. (2009). Behavioural responses to climate change: Asymmetry of intentions and impacts. *Journal of Environmental Psychology*, 29(1), 13-23. <https://doi.org/10.1016/j.jenvp.2008.05.003>
- Whitmarsh, L. (2011). Scepticism and uncertainty about climate change: Dimensions, determinants and change over time. *Global Environmental Change*, 21(2), 690-700. <https://doi.org/10.1016/J.GLOENVCHA.2011.01.016>
- Williams, T. J., Schimel, J., Hayes, J., & Faucher, E. H. (2012). The effects of existential threat on reading comprehension of worldview affirming and disconfirming information. *European Journal of Social Psychology*, 42, 602–616. <https://doi.org/10.1002/ejsp.1849>
- Wolfe, S. E., & Brooks, D. (2016). Mortality awareness and water decisions: A social psychological analysis of supply management, demand management and soft path paradigms. *Water International*, 42(1), 1-17. <https://doi.org/10.1080/02508060.2016.1248093>
- Wolfe, S. E., & Tubi, A. (2018). Terror management theory and mortality awareness: A missing link in climate response studies? *WIREs Climate Change*, 10(2), Article e566. <https://doi.org/10.1002/wcc.566>
- Yalom, I. (1980). *Existential therapy*. Basic Books.

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APPENDIX A

Descriptive features of TMT-environment articles reviewed.							
Authors	First Author Affiliation	Journal	Journal Discipline	Country of Study	Study Time Period	Participants/ Material	Cites
Akil, H., Robert-Demontrond, P., & Bouille, J.	Management	<i>Recherche et Applications en Marketing</i>	Marketing	France	not specified	French adults	6
Atalay, A. S. & Meloy, M. G.	Management, Finance	<i>Journal of Nonprofit & Public Sector Marketing</i>	marketing/ communication in non-profit and public sectors	USA	not specified; S3 2015	S1, S3 US Mturkers; S2 US undergraduates	0
Barth, M., Masson, T., Fritsche, I. & Ziemer, C.-T.	Psychology	<i>Group Processes & Intergroup Relations</i>	Social Psychology; processes within and between groups	Germany	not specified	S1 & S2 German university students; S3 Germans	15
Buttler, B., Latz, M. & Walther, E.	Psychology	<i>Basic and Applied Social Psychology</i>	Social Psychology	Germany	4 weeks/ study; S1 ~2011 post-Fukushima; S2 ~2015 post local nuclear threat	S1 German university staff, students; S2 German university students	1
Cote, S. & Wolfe S.E.	Environment, Resources and Sustainability	<i>Applied Environmental Education & Communication</i>	Environment: social marketing, education, sustainability, government and	Canada	material post 1980	marketing/ promotional material from pro- and anti-bottled water campaigns	0

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			corporate public communication			distributed in Canada	
Cote, S. A., Ross, H. C., David, K. & Wolfe, S. E.	Environment, Resources and Sustainability	<i>Ecology and Society</i>	Ecological, political, and social foundations for sustainable social-ecological systems	Canada	2000-2015	15 years of Walkerton crisis Canadian print media coverage	5
Fritsche, I., Cohrs, J. C., Kessler, T. & Bauer, J.	Psychology	<i>Journal of Environmental Psychology</i>	Environmental Psychology	S1A & SB Germany; S2 UK	not specified	S1A & SB German students; S2 British students	42
Fritsche, I. & Häfner, K.	Psychology	<i>Environment and Behavior</i>	Environments and human behavior; interdisciplinary	Germany	not specified	S1 German undergraduates; S2 Germans	86
Fritsche, I., Jonas, E., Kayser, D. N. & Koranyi, N.	Social Psychology	<i>Journal of Environmental Psychology</i>	Environmental Psychology	S1 & S2 USA; S3 Germany	not specified	S1 & S2 US undergraduates; S3 German undergraduates	136
Harrison, P. R. & Mallett, R. K.	Psychology	<i>Ecopsychology</i>	Psychology and mental health in ecological context	USA	not specified	US psychology undergraduates	15
Hu, S., Zheng, X., Zhang, N. & Zhu, J.	Psychology	<i>Frontiers in Psychology: Personality and Social Psychology</i>	Personality and Social Psychology	USA	not specified	US Mturkers	3
Kasser, T. & Sheldon, K. M.	Psychology	<i>Psychological Science</i>	Psychology	USA	not specified	S1 US college students; S2 US Psychology students	609
Koole, S. L. & Van den Berg, A. E.	Social Psychology	<i>Journal of Personality and Social Psychology</i>	Personality and Social Psychology	Netherlands	not specified	Netherland university students	196

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Lifshin, U., Greenberg, J., Weise, D., & Soenke, M.	Psychology	<i>Personality and Social Psychology Bulletin</i>	Personality and Social Psychology	USA	not specified	US psychology undergraduates	10
Mann, C. & Wolfe, S. E.	Environment, Resources and Sustainability	<i>Water Resources Management</i>	Multidisciplinary water resources management	Canada	June 2014	Toronto adults	13
Pyszczynski, T., Motyl, M., Vail, K.E., Hirschberger, G., Arndt, J., & Kesebir, P.	Psychology	<i>Peace and Conflict: Journal of Peace Psychology</i>	Peace and Conflict Psychology	S1 & S2 USA; S3 Israel	S1-2 not specified; S3 Jan 2009, during Israeli invasion of Gaza	S1 & S2 US Psychology students; S3 Muslim Palestinian students in Israel	42
Rahimah, A., Khalil, S., Cheng, J. M.-S., Mai, D. T., & Panwar, V.	Business Administration	<i>Journal of Consumer Behaviour</i>	Consumer behaviour, consumer research and consumption	Taiwan	not specified	Taiwanese grocery shoppers	20
Rahimah, A., Khalil, S., Huu, P. D., & Cheng, J. M.-S.	Business Administration	<i>Journal of Retailing and Consumer Services</i>	Retailing and service studies, consumer behaviour	Indonesia	not specified	Indonesian adult shoppers	3
Ross, H. & Wolfe, S. E.	Environment and Resource Studies	<i>Water History</i>	Water history and management	USA	1921-1946	America-wide news sources	2
Sélimbegovic, L., Chatard, A., Er-Rafiy, A., & Pyszczynski, T.	Psychology; Cognition and Learning	<i>Journal of Environmental Psychology</i>	Environmental Psychology	France	S1, S3 not specified; S2 two sessions,	S1 French; S2 & S3 French undergraduates	3

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					12 days apart		
Uhl, I., Klackl, J., Hansen, N., & Jonas, E.	Psychology	<i>Group Processes & Intergroup Relations</i>	Social Psychology; processes within and between groups	Austria, Argentina	not specified	Austrians and Argentinians from university and social networks	18
Vess, M. & Arndt, J.	Psychology	<i>Journal of Research in Personality</i>	Personality Psychology	USA	not specified	US psychology undergraduates	120
Vess, M., Arndt, J., & Cox, C. R.	Psychology	<i>Social Psychological and Personality Science</i>	Personality and Social Psychology	USA	not specified	US psychology undergraduates	11
Wang, X. & Chao, C.-H.	Business, Economics, Management	<i>Business Research Quarterly</i>	Multidisciplinary management	Not specified	not specified	Mturkers	4

APPENDIX B

Method summaries of TMT-environment articles reviewed.	
Source	Study # and Method Summary

Please cite as: Smith, L., Ross, H., Shouldice, S. and Wolfe, S. (2022) "Mortality management and climate action: A review and reference for using Terror Management Theory methods in interdisciplinary environmental research." *WIREs Climate Change*. <https://doi.org/10.1002/wcc.776>

Akil et al. (2018)	Participants completed Environmental Contingencies of Self-Worth scale and materialism scale, then shown either anxiety inducing or informational climate video, followed by PANAS and word search. Participants then completed questionnaire to make consumption choices between pro-materialistic or pro-environmental products and services. Demographic information collected.
Atalay et al. (2020)	S1: Participants completed either MAPS or control (watching TV), then a word scramble and PANAS, before responding to a hurricane scenario with an evacuation directive, measuring appeal, risk, and comfort of the directive. Demographic information collected.
	S2: Participants completed either MAPS or control (listening to music), then a word search. All participants then responded to a hurricane scenario with an evacuation direction either with or without choice of location, and rated likelihood of compliance.
	S3: Conducted during Category 5 hurricane about to reach Texas and Louisiana that was broadcasted widely across US news. Participants read a hurricane scenario with an evacuation directive either with or without choice of location, and rated likelihood of compliance.
Barth et al. (2018)	S1: Demographic info collected before participants answered yes/no questions about either climate change consequences or trivia facts about Germany (where study was located). PANAS and sleeping habit questions then answered as delays before responding to ingroup saliency task (e.g., write three things you and other students are good/bad at). A group authoritarianism scale and climate change perceived threat measure were then administered, before political orientation and identification with other students (beneficial and non-beneficial ingroup members) measures.
	S2: Participants received climate change information that either focused on serious climate consequences or also highlighted potential benefits, before measuring perceived climate threat. PANAS and demographic information collected as delays. A sexist German professor vignette was presented, noting students either agreed or disagreed with an activist group's protest response to the behaviour. Acceptance of moderate and radical behaviour measure administered before beneficial/non-beneficial member (as in S1). Political orientation, personal involvement, solidarity with activist group, control, and environmental attitudes also measured before rating the climate text.
	S3: Same as S2 but used the threat manipulation from S1 (climate consequences vs trivia). PANAS after threat manipulation as delay, and ingroup norm manipulation from S2 (sexist vignette and reactions). Climate threat perception measure moved to end to avoid threat saliency before dependent variable measures in control group.
Buttler et al. (2017)	S1: Measurement of paper towels used in bathrooms at a university. Baseline use measured over two weeks, then use over the third week with presence of poster asking to use fewer paper towels. In the fourth week, a poster showing an image of the recently, severely damaged Fukushima nuclear plant was included on another poster in bathrooms, inviting viewers to a discussion, and paper towel use measured at the end of the fourth week.

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	S2: Replication of S1, with napkin use in cafeteria. Baseline assessed at T1, then a request poster to use less napkins introduced, and use remeasured one week later. A week after the second measurement, flyers were distributed to students across cafeteria about a problem at a nearby nuclear power plant, and students who took a flyer had their napkin use measured.
Cote & Wolfe (2017)	Content analysis of pro- and anti-bottled water campaigns/advertisements. Images and text were coded for four TMT themes (self-esteem, worldview defense, denial of risk, mortality salience), via codebook, and frequencies counted. Death reminders noted as implicit or explicit.
Cote et al. (2018)	Content analysis of 15 years of national and local news coverage of Walkerton crisis to identify MS and proximal/distal responses. Items coded according to TMT positive and negative emotion codebook, categorized by emotional valence and temporality, with frequency counts of items coded.
Fritsche et al. (2010)	S1: Participants completed cover tasks in a garbage strewn laboratory during norm salience manipulation. Confederate either apologized and cleaned up room or ignored mess and kicked garbage around. The next set of tasks involved participants completing either MAPS or dental control, followed by PANAS and a word puzzle as delays. Two car ads were presented, one environmentally friendly and the other for a SUV, and participants asked to evaluate ads and ad authors. Final survey on environmental topics before choice of lottery entry for either environmental or non-environmental thriller movies.
	S2: Replication of S1 with an environmental commons game. First, participants completed a lexical decision task involving a mortality or pain prime, then completed a norm manipulation task questionnaire that involved information similar to 'tragedy of the commons' or the 'invisible hand' idea from economics. This primed either common-interest or self-interest norms. The environmental commons decision followed.
	S3: Participants completed demographic questions and saw cover story stating they were in a marketing study, noting they would receive a hot beverage at end in their choice of disposable or reusable cup. Then told to enter a code written on a blackboard where there was also a poem written with either death words circled in the MS condition, or with neutral words instead of death in the control. Participants then answered beverage questions and evaluate a beverage ad which for half displayed pro-environmental norms. Participants then received a hot beverage and chose either reusable or disposable cups before completing a survey on cup choice intentions and drink satisfaction.
Fritsche et al. (2012)	S1A: After demographic questions, participants answered whether or not they knew sets of facts about either threatening or non-threatening local climate/environmental statements. Half of each set then completed the PANAS and sleep questions as delays and the 'no-delay' condition completed the PANAS after the dependent variables. The DVs were evaluations of deviant or system supporting groups, and a recommended imprisonment length for a rapist. Authoritarian aggression and submission were then measured, followed by climate threat perception measures.

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	S1B: Replication of S1A, with more extreme climate threat manipulation, and all participants received delays. In addition to deviant and system supporting group measurements, derogated and dissident group measures were added. After the authoritarian measures, political orientation was also measured.
	S2: Replicated S1A/B in UK sample (as opposed to German). Added system justification as a dependent variable. National identification measure added.
Fritsche & Häfner (2012)	S1: Demographic questionnaire and filler questions, then either MS manipulation or response to questions on dental pain. PANAS and opinion surveys on media use and various policies as delays. Global environmental attitude survey with anthropocentric and biocentric pro-environmental motivation scales.
	S2: Replication of S1 in non-student sample. Delays were PANAS and questions on sleep/awakening. Used German translations of Ecocentric and Anthropocentric Attitudes Questionnaire, Environmental Motives Scale, then filler task, and Environmental Identity Scale as dependent variables.
Harrison & Mallett (2013)	Demographic information and environmental values measured before value salience manipulation – writing about either environmental or everyday values. Participants then wrote about either their own death or dentist, before a collective eco-guilt measure and PANAS.
Hu et al. (2018)	Participants completed MAPS (MS), neutral (groceries), or control (dentist), before PANAS and word search delays. Attitudes toward future generations and SDGs then measured before demographic information collected and questions on religion, whether they had children, and whether they worked in a hospital.
Kasser et al. (2000)	S1: Materialism measure followed by filler surveys and MS manipulation or control (listening to music). One filler survey as delay before asked to think about 15 years in future and answer questions about financial status.
	S2: Participants completed Aspiration Index followed by materialism/motivation measures, before completing filler surveys followed by MS manipulation (writing about own death or music). They then participated in a forest management/resource dilemma game to measure greed and fear.
Koole et al. (2005)	S1: Unrelated surveys administered before Environment and Thoughts survey (indicate where -wild vs cultivated vs city-most likely to think about different topics, including death), followed by demographic questions.
	S2: Personality questionnaires followed by MS manipulation (Fear of Death Inventory) for MS condition – Inventory administered at the end of the study for the control group. Reaction time tasks and word puzzles as delays before judging beauty of Dutch landscapes (wild, cultivated, or intermediate).
	S4: Threat-Related Action Orientation Scale administered among other personality surveys before dot-recognition task (nature photograph priming task – wild vs cultivated). Filler task as delay, then lexical-decision task with MS, nature, and valence primes (death word vs non-word; wilderness vs cultivated nature; positive vs negative valence), followed by unrelated surveys and demographic information.

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	S5: Threat-Related Action Orientation Scale administered among other personality surveys before mood survey. Word association task as subliminal death prime (death vs xxxxx vs pain) and another mood rating before filler task. Landscape photo appraisal (wild vs cultivated), filler, mood rating, and demographic information.
Lifshin et al. (2016)	S4: Measured soul belief, religiosity, and political attitude, personality filler survey, then MS induction (symbolic immortality prime vs MAPS vs dental pain), followed by delay (PANAS) and article appraisal (end of world due to climate change vs scientific heavy element).
	S5: Measured soul belief, religiosity, and political attitudes several weeks in advance. Personality filler surveys as cover before symbolic immortality prime vs boredom control, then delay survey. Climate change end of world article presented with longer time scale than S4 (200 years vs 50 years) with appraisal questions.
Mann & Wolfe (2016)	Survey distributed after major flooding event in Toronto, Ontario. Presented with articles and manipulation (MS described fatal consequences from international typhoon, control described climate change effects on wine production) before PANAS as delay and questions on prior flood experiences, and positive/negative emotional responses to flooding. Risk perceptions for future flooding then recorded.
Pyszczynski et al. (2012)	S1: Filler questionnaires completed before catastrophic imaging exercise (global climate change vs local earthquake), then MS manipulation (MAPS vs dental pain). Word search as delay before Support for Diplomacy Scale.
	S2: Replication of S1, with same global catastrophe but a control that was flooding in China rather than local earthquake. MS manipulation (MAPS vs personal uncertainty) with word search as delay. Measured support for war against Iran
	S3: Participants were Palestinian Muslim citizens of Israel during the January 2009 Israeli invasion of Gaza. The same global climate change catastrophe was presented with localized catastrophe a major earthquake in Israel. MS manipulation (MAPS vs dental pain) before measure of desire for peaceful coexistence with Israeli Jews. Filler leisure questionnaire given next as delay before Perceived Common Humanity scale and demographic questions.
Rahimah et al. (2018)	Death anxiety and individual social responsibility measured before environmental concern and pro-environmental behaviour, then green product purchasing attitudes and intentions. Mastery and demographics were also measured.
Rahimah et al. (2020)	Mortality salience and self-esteem scales before materialism and environmental concern measures. Consumer social responsibility and religiosity measured before demographic information collected.
Ross et al. (2016)	Codebook developed to identify negative and positive, implicit and tacit emotions and MS evidence/instances of symbolic immortality within news media concerning the Hoover Dam over a 15-year period (preconstruction, during construction, postconstruction).
Selimbegovic et al. (2016)	S1: Demographics and political orientation measured, then environmental protection attitude measure. Priming manipulation (nuclear accident reminder, similar to MAPS vs dental pain) followed by nuclear energy attitudes measure.
	S2: Environmental protection attitude measure, MS manipulation (MAPS vs dental vs Fukushima) followed by nuclear energy attitudes measure. 12 days later, nuclear energy attitudes measured again.

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	S3: Attitude towards Green party measured before subliminal word priming task (neutral vs failure vs nuclear) followed by lexical decision word/non-word task (DTA measure) and nuclear energy attitudes measure.
Uhl et al. (2018)	Demographic information collected before participants received ingroup affirmation manipulation or control (list positive traits of group you identify with vs current thoughts). Participants then read about either threatening climate change or non-threatening statements about Earth. PANAS as delay. Pro-environmental behaviour measured followed by ethnocentrism (measure of symbolic defensive behaviour).
Vess et al. (2008)	Environmental contingency of self-worth (ECSW) measure prior to the study. Mortality salience manipulation (MAPS vs pain) followed by two delays (PANAS, word search). Article about lawsuit regarding denial of construction on wetland and questions about agreeance, environmental impact, etc., followed by environmental concern measure.
Vess et al. (2012)	S1: Religious fundamentalism and ECSW measured prior to study. In study, completed personality measures followed by DTA measure (word completion task). Connectedness to nature scale followed by religiosity measure.
	S2: Cover measures followed by ECSW measure among other self-worth measures. Religious fundamentalism scale followed by MS manipulation (MAPS vs exam failure). PANAS and word search given as delays, followed by connectedness to nature measure.
	S3: Cover measure followed by religious fundamentalism measure and another filler measure. MS measure (Fear of Death Scale vs questions on dental pain) followed by PANAS and word search delays. Connectedness to nature measured (different measure than used in S1 and S2), followed by demographic information, ECSW, and political orientation.
Wang & Chao (2020)	S3: ½ participants MS primed, ½ control. In each group, ½ participants primed with nostalgia or ordinary event (control) and ½ primed with green product vs control. Nostalgia primed first, then MS (MAPS vs dental pain), followed by PANAS and filler questions as delays. Death anxiety scale used as manipulation check followed by time orientation measure (Zimbarbo Time Perspective Inventory). Presented with vignette about buying new copy paper which is either 'green' or 'multipurpose', depending on condition assigned. Participants then rated the product.