Climate change information profiles: Mapping epistemic variation across multiple domains

Jan Eckardt

The University of Western Ontario

November 2026

Conference draft prepared for the Toronto Political Behaviour Workshop, November 13–14, 2026. Please do not cite without the author's permission.

Abstract: *How people understand climate change and its implications for climate-related outcomes are central concerns in climate public opinion research. While prior work has generated important insights, existing approaches to conceptualizing climate information face two limitations. First, while research on political misperceptions has distinguished informed, misinformed, and uninformed responses as distinct epistemic orientations, prior work has largely relied on dichotomous classifications separating correct from incorrect beliefs. Second, prior studies have focused on information concerning the existence and causes of climate change, despite increasing contestation surrounding policy responses, climate science, and the broader climate movement. To address these weaknesses, the present study employs a novel battery distinguishing between informed, misinformed, and uninformed responses across five domains of climate information in Canada (n = 1,601), the United States (n = 1,598), and Japan (n = 1,599). Latent class analyses identify universal and country-specific climate information profiles characterized by distinct epistemic patterns across domains. Bayesian Additive Regression Trees (BART) are then used to examine predictors of profile membership, with estimates showing that the most important determinants differ across profiles. Subsequently, BART models examine the role of information profiles in predicting climate-related outcomes. Results show that profiles form a continuum, with informed profiles most pro-climate, misinformed profiles least, and uninformed profiles intermediate. Finally, preregistered analyses demonstrate that this expanded conceptualization improves predictive performance for climate-related outcomes. These findings suggest that existing approaches may overlook important variation in public climate information and provide a more comprehensive framework for studying climate change information.*

Introduction

People's understanding of climate change has important implications for how they engage with climate change. Studies consistently show that the degree to which individuals hold accurate beliefs about climate change influences climate concern (e.g., Bostrom et al., 2019; Kahan et al., 2015; van der Linden, 2015), perceived climate efficacy (Hurst Loo & Walker, 2023; Kiral Ucar et al., 2023), and support for climate policies (Bergquist et al., 2022; Ding et al., 2011), and affect the extent to which they engage in pro-environmental and sustainable behaviors (Kolenatý et al., 2022; Vainio & Paloniemi, 2013; Zawadzki et al., 2020).

Despite the breadth of work in this area, prior studies often rely on somewhat simplistic conceptualizations of public understanding, which limits their ability to accurately capture its distribution, determinants, and outcomes. First, most pre-existing studies treat information about climate change in dichotomous terms, focusing on contrasts like knowledge versus ignorance (Ding et al., 2011; Motta et al., 2019; Tobler et al., 2012), skepticism versus acceptance (de Graaf et al., 2023; Hornsey et al., 2016; Sibley & Kurz, 2013), and misinformation versus accurate information (Cook et al., 2017). Such an approach, however, neglects the possibility that some individuals may simply lack strongly held beliefs (see Kuklinski et al., 2000).

Second, studies tend to assess public understanding of climate change by focusing on whether they hold accurate beliefs about the existence and causes of climate change (e.g., Haltinner & Sarathchandra, 2021; Hornsey et al., 2016; Lewandowsky et al., 2013; Sibley & Kurz, 2013). This, however, overlooks a broadening range of climate-related claims people may encounter in the information environments they are embedded in. In particular, recent years have seen a substantial expansion of the portfolio of misinformation disseminated across both offline and online media (Boussalis & Coan, 2016; Busch & Judick, 2021; Jacques & Knox, 2016; Painter et al., 2023; Nicolosi et al., 2025). Such misinformation increasingly encompasses claims about

climate change's impacts, climate policy responses, climate science, and the climate movement (see Coan et al., 2021).

Third, and following from the above, little attention has been paid to how epistemic states vary across different domains of climate change. While some studies distinguish between different forms of climate skepticism and denial (Haltinner & Sarathchandra, 2021) or examine multiple dimensions of climate attitudes (Capstick & Pidgeon, 2014; Whitmarsh, 2011), they generally do not account for the possibility that individuals may occupy different epistemic states depending on the specific domain of climate change information being considered (for an exception, see Sibley & Kurz, 2013). For example, individuals may be informed about the existence of climate change, misinformed about its causes or impacts, and uncertain about climate policy or climate science more broadly. With regard to relevant outcomes like policy support and climate concern, it remains unclear whether outcomes differ depending on how information, misinformation, and uncertainty are distributed across different domains of climate change information.

The study aims to make a theoretical contribution by addressing these shortcomings and classifying individuals into "climate information profiles" that reflect distinct patterns of factually correct information, misinformation, and ignorance across multiple aspects of climate change. After testing a set of pre-registered hypotheses examining whether allowing epistemic states to vary across different domains improves both the representation of the public's understanding of climate change and the predictive power of models estimating relevant outcomes, I turn to an exploratory analysis of the determinants and outcomes of these configurations. To do so, I draw on three datasets collected in Canada (n = 1,601), Japan (n = 1,599), and the United States (n = 1,598).

Across the three countries, I identify several distinct climate information profiles, ranging from those characterized by a coherent epistemic classification across climate domains (i.e.,

consistently informed, uninformed, or misinformed across domains) to those exhibiting different epistemic states depending on the domain under consideration. Bayesian Additive Regression Tree (BART; Chipman et al., 2010) analyses further reveal that these profiles differ systematically in the combinations of values, trust, ideology, climate experience, and lifestyle-related factors associated with profile membership. Finally, an additional set of BART models shows that profile membership is associated with substantively different levels of climate concern, policy support, climate efficacy, and pro-climate behavior. These analyses also show that the expanded conceptualization of climate information proposed here generally provides greater predictive performance for these commonly studied outcomes than the conceptualizations conventionally employed in the literature.

Approaches to understanding information about climate change and their limitations

Framing and measurement of information about climate change

While much research on information about climate change and its determinants and outcomes exists, the exact way in which this concept is framed and studied varies considerably across studies. A large part of this literature focuses on subjective epistemic evaluations of climate change related content, like skepticism (Capstick & Pidgeon, 2014; Hornsey et al., 2018; Haltinner & Sarathchandra, 2021), perceptions (van Valkengoed et al., 2021; van Valkengoed et al., 2024), denial or doubt (Boulianne & Belland, 2022; McCright et al., 2016; Sarathchandra & Haltinner, 2023), or beliefs (Hornsey et al., 2016; Geiger et al., 2025; Većkalov et al., 2024; Vainio & Paloniemi, 2013). Other work instead focuses on more objective dimensions like technical knowledge or climate literacy (Kolenatý et al., 2022; Shi et al., 2016; Tobler et al., 2012). Yet another strand examines misinformation or misperceptions about climate change, which also concern factual accuracy but from a perspective centered on factual *inaccuracy* (Cook et al., 2017; Geiger et al., 2025; Spampatti et al., 2023). While such research is rare, some studies explicitly integrate multiple of these conceptualizations and model relationships

between them. For example, these studies may examine how technical knowledge shapes climate related beliefs (Guy et al., 2014) or how misperceptions can be reduced by fostering knowledge (Moxnes & Saysel, 2009). More often, however, these distinctions are not clearly theorized, and definitions overlap in practice, even within the same measurement scales (Hilbig, 2024). In this study, climate information is operationalized in line with research that focuses on the extent to which respondents hold information that is objectively true or false, as such conceptions are likely *antecedents* of subjective beliefs and perceptions (Guy et al., 2014).

Epistemic distinctions and uncertainty

Irrespective of the specific climate change-related informational states under consideration, and with a few notable exceptions (Haltinner & Sarathchandra, 2021; Sibley & Kurz, 2013), prior research tends to rely on dichotomous distinctions that collapse epistemic variation into binary oppositions. For instance, studies may distinguish between correct information and lack of correct information or beliefs (e.g., Motta et al., 2019; Tobler et al., 2012), skeptics and non-skeptics (e.g., Leka & Furnham, 2024), or those who are misinformed and those who are not (e.g., Cook et al., 2017).

Research on political misperceptions, however, has long highlighted the importance of epistemic uncertainty. Consequently, this field has drawn a distinction between *misinformed* individuals, who hold firmly endorsed false beliefs, and merely *uninformed* individuals, who lack relevant information or beliefs (Kuklinski et al., 2000; Pasek et al., 2015). While developed in the context of misperceptions, this distinction may offer useful insights for how climate change research conceptualizes epistemic states, particularly in relation to ambivalence and intermediate forms of belief. Specifically, this implies that epistemic states may be better understood as spanning a continuum ranging from confidently held false beliefs to confidently held correct beliefs, with weaker or uncertain positions in between.

While not explicitly drawing on this line of research, Poortinga et al. (2011) call for greater attention to ambiguity among individuals holding inaccurate information about climate change. More recently, Haltinner and Sarathchandra (2021) have extended this line of work by distinguishing between epistemic deniers, epistemic doubters, attribution deniers, and attribution doubters, and find that doubters represent a qualitatively distinct group from those who outright deny the existence or the anthropogenic nature of climate change, or both. Moreover, next to climate deniers, those who believe claims about climate change are exaggerated, and those who perceive expert disagreement about its causes, Whitmarsh (2011) identifies uncertainty about whether climate change is happening as a distinct dimension of climate skepticism. Such differentiation is rare, however, and is rarely integrated in ways that fully capture the continuum of epistemic states implied by work like Kuklinski et al. (2000).

Domains of information about climate change

Irrespective of how epistemic states are distinguished, studies also rarely consider the full range of climate change information domains that are central to contemporary debates about climate change and climate action. Instead, studies typically focus only on information about the existence of climate change and its causes (e.g., Diamond et al., 2020; Motta et al., 2019; Hornsey et al., 2018; Zawadzki et al., 2020). While these more settled aspects of climate change remain relevant in public debate and discourse, they have increasingly been supplanted by contestation concerning its impacts, the usefulness of proposed policy responses, the climate movement, and climate science itself (Painter et al., 2023; Nicolosi et al., 2025).

In recent work, Coan et al. (2021) created a typology of five main categories of false claims spread by anti-climate think tanks and contrarian blogs: These intend to sow doubt on (1) the existence of climate change, (2) its anthropogenic roots, (3) its negative impacts, (4) (political) responses to climate change, (5) the reliability of the climate movement and climate science. Such findings by Coan et al. (2021) and others on the changing landscape of misinformation

claims are particularly relevant given that studies examining beliefs in the population have found the reality of climate change and its human causes to be accepted by large majorities in many populations (Tobler et al., 2012; Većkalov et al., 2024). Since studies examining public understandings of climate change still tend to focus primarily on its existence and causes, prior studies may therefore draw an incomplete picture of how people understand climate change. While other work has examined additional domains, including climate impacts, climate science, and policy responses (e.g., Ding et al., 2011; van Valkengoed et al., 2021; Whitmarsh, 2011; Capstick & Pidgeon, 2014), these domains are rarely brought together within a unified framework of climate change information.

Advancing a more holistic conceptualization of public climate change understanding

Taken together, the discussion above suggests that the literature on climate information is characterized by two related conceptual limitations. First, much of the research relies on dichotomous epistemic categorizations, distinguishing between groups such as skeptics and non-skeptics, the misinformed and non-misinformed, and those who hold accurate beliefs compared to those who do not. Yet, the discussion above highlights that accounting for uncertainty and ambivalence requires distinguishing between three distinct epistemic states. Specifically, respondents can be *informed* on a given topic when they confidently hold accurate beliefs, *misinformed* when they confidently hold objectively false beliefs, or *uninformed* when they do not confidently hold either accurate or inaccurate beliefs. Prior work thus tends to neglect a potentially important theoretical group of individuals who fall outside a dichotomous conceptualization of epistemic states. Second, empirical work has primarily focused on beliefs about the existence and causes of climate change, while comparatively less attention has been given to other domains such as its impacts, policy responses, climate science, and the climate movement.

Importantly, some prior work on climate skepticism suggests that different epistemic states can vary across domains within individuals (Haltinner & Sarathchandra, 2021; Sibley & Kurz, 2013). Building on this, a more integrated approach would allow for mapping epistemic states, here conceptualized as *informed*, *misinformed*, and *uninformed,* across multiple domains of climate change information, including its existence (1), causes (2), impacts (3), policy responses (4), and climate science and the climate movement (5) (Coan et al., 2021). This yields a first exploratory research question about how such an expanded conceptualization of epistemic states and domains is reflected in patterns within the information about climate change held by individuals.

RQ1: What patterns of climate change information emerge when considering informed, misinformed, and uninformed epistemic states across multiple domains?

Climate change information and its correlates

Determinants of climate change information

While mapping the climate information held by the public represents an important first step, much of the literature in this field is dedicated to understanding the factors that influence variation in the information people hold. This line of research is particularly concerned with factors that increase susceptibility to misinformation, skepticism and inaccurate beliefs. Psychological variables like right-ideology, hierarchical, individualistic, free-market and self-enhancement values, and especially, a weaker pro-environmental worldview (Bostrom et al., 2019; Boulianne & Belland, 2022; Capstick & Pidgeon, 2014; Grapsas et al., 2023; Heath & Gifford, 2006; Hornsey et al., 2016; Hornsey et al., 2018; Whitmarsh, 2011; Ziegler, 2017), appear to act as particularly important predictors of such conceptions.[1] Similarly, in a study of

[1] A pro-environmental worldview, often captured by the New Ecological Paradigm (NEP), is typically conceptualized as a predictor of climate information in prior work (see Hornsey et al., 2016). One could, however, argue that the relationship may also operate in the opposite direction, with greater climate information potentially contributing to the formation of deeper ecological orientations. While I acknowledge this as a

the role of trust in climate denial in eight countries, Ejaz et al. (2024) find that trust in specific sources of information on climate change, like scientists, environmentalists, and international organizations, is associated with lower susceptibility to climate denial, whereas trust in energy companies and politicians is associated with higher susceptibility. In a related comparative study, Boulianne and Belland (2022) find that trust in President Trump as a source of information plays a particularly important role in predicting climate denial, whereas ideological positions overshadow such trust-based factors in Canada. More stable psychological dispositions also appear to shape variation in information about climate change. Prior studies have found Openness to Experience to be associated with greater belief in climate change and lower belief in climate myths (Freminot et al., 2024; Tucholska et al., 2024), with more mixed or inconclusive findings for the remaining Big Five traits. Similarly, Social Dominance Orientation (SDO) has been found to play a particularly important role in climate denial (Häkkinen & Akrami, 2014), while conspiracy mentality has also been linked to the belief that climate change is a hoax (Lewandowsky et al., 2013). Perhaps surprisingly, findings regarding socio-demographic variables like age, gender and religion tend to be more mixed (Ecklund, et al., 2017; Hornsey et al., 2016; Whitmarsh, 2011, but see Morrison et al., 2015 for conflicting findings on the role of religion). Similarly, evidence on the role of contextual factors, like exposure to extreme weather events (Hornsey et al., 2016; Howe, 2021), media consumption (Diehl et al., 2021; Ejaz et al., 2024), and cultural influences (Nartova-Bochaver et al., 2022) is inconclusive, or these factors show relatively weak predictive power on their own.

A more novel but promising avenue concerns the role of lifestyle and occupational interests. In line with ideas of motivated cognition (Kunda, 1999), Hornsey and Lewandowsky (2022) suggest that the objective evaluation of information about climate change "might be especially

potential limitation of the research design, I follow the conventional assumption that pro-environmental worldview predicts climate information in this study.

unrealistic when change is painful (for example, for individuals whose livelihood is reliant on fossil fuel industries or for people with a large carbon footprint that is costly to shrink)" (p. 1455). While observational evidence remains limited, existing studies suggest that factors such as occupational sector and lifestyle choices may shape climate information, which highlights the need for broader analyses of the role of personal interests in influencing climate-related conceptions (Tvinnereim & Ivarsflaten, 2016; Vazquez et al., 2021; but see Stoetzer & Zimmermann, 2024 for conflicting findings from an experimental study).

Finally, some of the few studies investigating more complex typologies of how people conceive of climate change suggest that different subgroups are qualitatively distinct and characterized by different predictors. For example, Haltinner and Sarathchandra (2021) find that while denial of the existence and human causes of climate change is associated with right-wing ideology, doubting these same aspects is not meaningfully associated with ideology. Similarly, Capstick and Pidgeon (2014) find that while individualism and lower pro-environmental identity predict both doubts about the scientific basis of climate change and doubts about the efficacy of responses to it, older age is uniquely associated with the former.

While these findings are informative, they share three limitations. First, these studies include a relatively narrow set of predictors, which leaves open the question of how a broader range of psychological, sociodemographic, and lifestyle factors influences how people make sense of different aspects of climate change.

Second, the typologies themselves remain relatively limited in scope and do not account for the full variation in epistemic states across the domains of climate change information highlighted by prior work as prominent areas of misinformation and contentious public debate (e.g., Coan et al., 2021; Nicolosi et al., 2025). Third, they rely on linear modelling frameworks that may obscure non-linear relationships and interactions between predictors. The present study aims to address these limitations by incorporating a broader set of predictors and

examining their influence on membership in distinct profiles of climate information in an exploratory fashion. This yields an additional exploratory research question:

> **RQ2:** What are the most important determinants of membership in different climate information profiles based on informed, misinformed and uninformed epistemic states across an expanded set of salient domains?

Outcomes of climate change information

Since inaccurate beliefs about climate change are a significant hurdle to climate action (Treen et al., 2020), many studies including climate change information as a central analytical variable have been focused on its impact on climate concern (see e.g., van der Linden, 2017; Shi et al., 2016), perceived climate efficacy (Kiral Ucar et al., 2023; Nielsen et al., 2021; van Valkengoed & Steg 2019), policy support (Bergquist et al., 2022; Ding et al., 2011; Pan et al., 2023; Stoutenborough & Vedlitz, 2014) and climate-related or otherwise sustainable behaviors (Kolenatý et al., 2022; Vainio & Paloniemi, 2013; Zawadzki et al., 2020). As one would expect, these studies tend to find knowledge or correct information to be positively associated with these outcomes (Drews & van den Bergh, 2016), while inaccurate beliefs are associated with lower levels of climate concern, efficacy, policy support, and, to a lesser degree, pro-environmental behaviors (Hornsey et al., 2016).

The literature also provides support for a more expansive conceptualization of climate information with regard to its relationships with these relevant outcomes. Notably, regarding epistemic ambivalence, Haltinner and Sarathchandra (2021) find denial to be more strongly associated with environmental concern than doubt, while doubt about the human causes of climate change shows a negligible and statistically non-significant relationship. Regarding differences across domains, Sibley and Kurz (2013) find that beliefs about the existence of climate change are more predictive of climate policy support and self-reported pro-

environmental behaviors than beliefs about its causes. Similar results are reported by de Graaf et al. (2023), who find a significant association between beliefs about the existence of climate change and responses to climate change, as well as acceptance of policies, like increasing taxes on fossil fuels and using tax revenues to invest in wind and solar energy. In contrast, the effects of beliefs about causes and impacts are indistinguishable from zero. However, they also find that only beliefs about climate change's impacts significantly predict sustainable behavioral intentions once relevant control variables are accounted for. Finally, Capstick and Pidgeon (2014) show that, among several domains of climate skepticism, response skepticism is a particularly strong predictor of lower concern about climate change.

In sum, these findings suggest substantial variation in how different epistemic states and their distribution across domains relate to central, widely studied outcomes. This motivates an analysis that treats climate information constructed from expanded epistemic states across a broader set of domains (existence, causes, impacts, responses, climate science, and the climate movement) as predictors of these outcomes. This yields a third exploratory research question.

RQ3: What associations between climate change conceptions and relevant outcomes emerge when considering informed, misinformed, and uninformed epistemic states across multiple domains?

Moreover, to formally test whether these expansions are meaningful, I formulate the following pre-registered hypotheses evaluating the incremental contribution of adding epistemic states, domains, and their combined specification in a stepwise manner:

H1: Predictive models incorporating epistemic distinctions (informed, misinformed, uninformed) will outperform models that focus exclusively on one of these categories in predicting relevant outcomes.

H2: Predictive models incorporating multiple domains of climate change information (impacts, responses, climate movement and science) will outperform models limited to existence and cause in predicting relevant outcomes.

H3: Predictive models that consider full variation on both epistemic states (informed, misinformed, uninformed) across an expanded set of domains of climate change information (existence, causes, impacts, responses, and the climate movement and science) will outperform models with reduced complexity in either dimension.

Case selection

To investigate these hypotheses and research questions, I drew on three country cases: Canada, the U.S., and Japan. The choice of these three settings was motivated by the differences in the way climate change misinformation may be prevalent in these settings and how it may interact with climate information in relationship to relevant outcomes

First, Hornsey et al. (2018) find that climate skepticism is more strongly linked to political ideology in countries with a high reliance on fossil fuels. In Canada and the U.S., the climate issue has been heavily politicized (Boulianne & Belland, 2022), with various pro-oil stakeholders shaping public discourse, including through the distribution of misinformation (Carroll et al., 2022; Oreskes & Conway, 2011). Beyond their reliance on fossil fuels, the two countries' geographical and cultural proximity may also contribute to similar patterns of public opinion on climate change (Lachapelle et al., 2012). Comparative studies accordingly observe

similar relationships between ideology and climate skepticism in both countries (Hornsey et al., 2018), even though this relationship appears to be more strongly mediated by trust in President Donald Trump in the U.S. (Boulianne & Belland, 2022). Despite these similarities, Canada and the U.S. differ in the extent to which climate policies are supported and also, in the degree of acceptance of inaccurate claims about climate change (Lachapelle et al., 2012).

In Japan, by contrast, indifference toward climate change is much more prevalent than outright skepticism, while a slightly smaller but still sizeable share of the population reports being alarmed about the issue (Kosugi & Baba, 2023). These findings align with a cross-national survey by Brechin and Bhandari (2011), which shows that the Japanese public expresses greater concern about climate change than citizens in Canada or the U.S., and that a majority is willing to accept personal and societal sacrifices to mitigate it. Support for climate policies is also generally high in Japan (Kosugi & Baba, 2023). At the same time, Brechin and Bhandari (2011) show that an overwhelming majority believed the government was already doing enough to address climate change, despite the reality that the Abe administration significantly cut back environmental policy (Incerti & Lipscy, 2018). Thus, Japan offers an interesting case, where the climate issue is less politicized (see Hornsey et al., 2018), and relationships with predictors and outcomes may show different patterns.

In sum, the three countries provide contrasting political and informational environments. The U.S., and to a somewhat lesser extent Canada, represent highly politicized contexts in which climate misinformation is closely tied to ideological conflict. By contrast, Japan represents a setting in which support for climate action coexists with lower salience and lower politicization of climate change.

Data and Methods

Data

Data for this study were collected in May 2026. Adult population samples from Canada and the U.S. were collected from Leger Opinion's survey panel. Since survey panel options are more limited in Japan, data collection was conducted in collaboration with PureSpectrum, which is a survey aggregator that recruits respondents from multiple panels within the country. Despite being an aggregator, PureSpectrum follows data quality standards comparable to those of individual panel providers and employs internal checks to prevent duplicate respondents from entering the survey. For Canada and the U.S., nested quotas based on age, gender and region were employed to increase the samples' representativeness. For Japan, nested quotas included age and gender, with separate quotas for each of the 47 prefectures.

In addition to panel providers' internal controls, the survey also included several in-survey quality assurance measures. These comprised a standard attention check, bot detection using Qualtrics' built-in reCAPTCHA feature, and an optical recognition task designed to limit growing threats posed by more advanced large language models (Westwood, 2025), as well as measures to limit cheating and speeding. Detailed information on these exclusion criteria and tasks can be found in Section A of the Appendix. After these exclusions, the final sample sizes were n = 1,601 in Canada, n = 1,598 in the U.S., and n = 1,599 in Japan.

Measures and operationalization

Information about climate change

To measure the climate change information held by respondents, the study relied on a 20-item battery of climate-related claims spanning five dimensions of climate misinformation identified by Coan et al. (2021): the existence of climate change (1), its causes (2), impacts (3), policy responses (4), and climate science and the climate movement (5), with four claims per

dimension. The battery is identical to a previously developed instrument by the author of this study and coauthors Turgeon, Pereira Filho, and Lachapelle (under review), with the exception of two items that were revised for the present study. Within the broader range of operationalizations of climate information discussed above, the measure employed here is designed to capture objective information rather than subjective perceptions, skepticism, or attitudes toward climate change. Loosely based on the pool of false claims identified by Coan et al. (2021) as circulated by North American anti-climate think tanks and blogs, the battery focuses on salient points of contention in contemporary climate discourse. To align with leading definitions of misinformation (Vraga & Bode, 2020), all claims were validated against Intergovernmental Panel on Climate Change (IPCC) assessments, ensuring that false claims clearly contradicted established scientific evidence and expert consensus.[2] The reports used to validate the inaccuracy of each claim alongside corresponding certainty levels are presented in Section B of the Appendix.

Two features of the measure allowed for distinguishing between informed, misinformed, and uninformed responses. First, each item asked respondents to choose between a correct and an incorrect claim, which allows for capturing endorsement of both accurate and inaccurate statements while also reducing the acquiescence bias common in Likert and true-false formats (Clifford et al., 2019; Hill & Roberts, 2023). Second, a follow-up certainty scale ranging from "not at all certain" (1) to "absolutely certain" (5) allowed distinguishing between firm endorsement and guessing or uncertain endorsement (Graham, 2023). In line with conventions in the study of political misperceptions, respondents indicating to be less than "very certain" (4), or selecting "I don't know which of the statements is true," when initially evaluating the claims were not classified as *informed* or *misinformed* (Graham, 2023; Pasek et al., 2015), but

[2] Four of the 20 items could not be validated using IPCC reports, as their content falls outside the scope of these assessments (e.g., item 18 concerning the influence of environmental groups on politicians). In these few cases, validation relied on alternative sources drawn from peer-reviewed research or publicly accessible data.

rather treated as *uninformed* regarding a given claim. The full battery, including incorrect and correct claims can be found in Section B of the Appendix.

Determinants of climate change information

To assess the exploratory research questions regarding determinants of climate information, the surveys included a range of variables identified in prior research as relevant predictors. These comprised standard sociodemographic indicators, political ideology, and cultural worldviews (individualistic, hierarchical, and egalitarian orientations) each measured using indices composed of two items per value dimension (Douglas & Wildavsky, 1982).[3] The surveys further included an item measuring support for free-market principles (Heath & Gifford, 2006) and a six-item short form of the New Ecological Paradigm scale (Dunlap et al., 2000; short-form used in Whitmarsh, 2008).

Trust was measured across eight information sources, building on those identified by Ejaz et al. (2024) as empirically associated with climate change denial.[4] To account for climate-related factors in respondents' environment, two items captured perceived changes in summer temperatures and self-reported experiences of harm from extreme weather events. In addition, general interpersonal trust was included as another trust-based predictor.

To examine the role of lifestyle threats in shaping motivated reasoning underlying acceptance of climate misinformation, five original items assessed the subjective importance of climate-relevant behaviors, including driving, long-distance travel, meat consumption, phone upgrades, and single-use product use, rated on a five-point scale from "not at all important to me" (1) to

[3] As Swedlow et al. (2020) point out, scales used to capture cultural worldviews often exhibit low face validity, meaning they do not clearly correspond to the theoretical concept they aim to measure. Relatedly, Johnson and Swedlow (2023) note that short scales like the 2-item scales employed here also tend to suffer from lower reliability. To address these concerns, I balanced the authors' suggestions for face validity while minimizing redundancy by replacing items with suitable alternatives when the two recommended items were highly similar.
[4] In the present study, six of these sources were retained from the original set, while one category ("celebrities") was replaced with "social media," and an additional source capturing artificial intelligence as an information source was included to reflect the increasingly important role of this information source in recent years.

"extremely important to me" (5), with an additional response option for cases where the behavior was not applicable (e.g., "I do not eat meat"). Relatedly, occupation was measured using the Eurobarometer item (EU-OSHA, 2023) to identify respondents in emissions-intensive sectors potentially threatened by climate policy. A more detailed overview of each variable's coding and underlying items can be found in Section B of the Appendix.

Outcomes of climate change information

To investigate how the refined conceptualization of climate information proposed in this study predicts relevant outcomes, the study examined associations between climate information and climate concern, climate policy support, climate efficacy, and self-reported climate-related behaviors. Climate concern was operationalized as an index of personal and global concern, measured on a five-point scale ranging from "not at all worried" (1) to "very worried" (5). Following van der Linden (2015), concern was measured in terms of worry, as more direct self-reports of concern or seriousness may overestimate respondents' true level of concern. Climate efficacy was assessed as an index combining outcome, collective, and governmental efficacy. Respondents indicated their agreement with three statements on a five-point scale ranging from "strongly disagree" (1) to "strongly agree" (5). Climate-related behaviors were measured using an index of five actions related to mitigation, adaptation, and activism. Respondents reported how frequently they engaged in these behaviors over the past six months on a five-point scale ranging from "never" (1) to "very often" (5). Finally, climate policy support was captured using an index of support for seven policies (subsidy-based, market-based, regulatory, and educational). Policy support was measured on the same five-point scale ranging from "strongly oppose" (1) to "strongly support" (5). The exact wording of all items is provided in Section B of the Appendix.

Latent Class Analysis

To identify distinct groups of climate information and examine RQ1, latent class analysis (LCA) was conducted separately for each country using the poLCA package in R (Linzer & Lewis, 2011). LCA is a statistical technique that is used to identify qualitatively distinct subgroups by assigning probabilities of class membership based on response patterns on categorical indicators (Weller et al., 2020).[5] A total of 15 count scores (representing a 3 × 5 matrix of three epistemic states and five domains) were entered into the LCA. These indicators reflected the number of times respondents' answers were classified as *informed*, *uninformed*, or *misinformed* across the five domains of climate information. Thus, for each indicator, respondents could receive a maximum score of 4 (one point for each item within a given domain). To illustrate this approach, Table 1 presents a hypothetical response pattern for a respondent across the 3 × 5 matrix. For example, within the existence domain, this respondent would receive a score of 3 out of 4 on the existence × informed indicator, 1 out of 4 on the existence × uninformed indicator, and 0 out of 4 on the existence × misinformed indicator.

	Existence	**Causes**	**Impacts**	**Policy responses**	**Climate science and movement**
Informed	3	2	2	1	2
Uninformed	1	1	1	2	0
Misinformed	0	1	1	2	2

Table 1: Example of distribution of epistemic states across different aspects of climate change.

To test H1–H3, the preferred specification employed in this study was compared to three alternative coding schemes applied to the indicators supplied to the LCA. To test H1, the full solution distinguishing three epistemic states across five domains was compared to an

[5] The count indicators are treated as ordinal rather than continuous, for which latent profile analysis (LPA) would be preferred (Weller et al., 2020). This choice is further justified by pronounced left skew in the misinformed indicators, which would severely violate the normality assumptions underlying latent profile analysis.

operationalization that only distinguished between correct and incorrect responses on the initial explicit choice item. To mirror an approach that ignores epistemic uncertainty, responses were coded based solely on respondents' initial choice between a correct and an incorrect statement, without reference to the follow-up certainty item. Respondents selecting the correct statement contributed to a certainty-blind accurate beliefs score, while selecting an incorrect statement contributed to an inaccurate beliefs score. Because the certainty-informed specifications classify "Don't know" responses as uninformed rather than treating them as missing, leaving these responses uncoded in the constrained specifications would have excluded a set of respondents from the constrained models whose answers were retained in the certainty-informed models. To avoid this, "Don't know" responses (20.5% of all responses in Canada; 22.3% in the U.S.; 22.4% in Japan) and missing values (0.01% in Canada; < 0.01% in the U.S. and Japan) on the initial choice item were assigned to the inaccurate beliefs count, consistent with prior approaches that sort respondents into a binary classification of accurate climate beliefs versus all other responses (e.g., Motta et al., 2019).

To test H1, the predictive performance of the preferred solution was compared with that of a model that reduced epistemic states to a dichotomous measure across the five domains. To test H2, the profiles derived from the complete indicator set were instead compared with those from a model that used the full three-state coding and included only items assessing knowledge of the existence and causes of climate change. To test H3, the full solution was then compared with a simpler model mirroring the approach commonly employed in prior work, which used a dichotomous coding of epistemic states and was restricted to items capturing information regarding the existence and causes of climate change. Below, Table 2 shows the included indicators included in each baseline and expanded model comparison used to test the hypotheses.

Hypothesis	Epistemic states baseline	Domains baseline	Epistemic states expanded	Domains expanded
H1	Accurate, inaccurate (certainty-blind)	Existence, causes, impacts, responses, science and movement	Informed, misinformed, uninformed	Existence, causes, impacts, responses, science and movement
H2	Informed, misinformed, uninformed	Existence, causes	Informed, misinformed, uninformed	Existence, causes, impacts, responses, science and movement
H3	Accurate, inaccurate (certainty-blind)	Existence, causes	Informed, misinformed, uninformed	Existence, causes, impacts, responses, science and movement

Table 2: LCA indicators across baseline and expanded models used to test H1–H3.

Since the number of profiles preferred by BIC may vary across model specifications, the number of profiles *K* was fixed to the optimal solution identified from the fully specified model (i.e., considering all 15 indicators). The optimal number of profiles was determined by identifying the point at which successive reductions in BIC decelerate most sharply, which selects the solution beyond which additional profiles yield diminishing improvements in fit. This ensures that marginal gains in BIC do not lead to unnecessarily complex solutions being preferred over more parsimonious ones. For a graphical representation of this selection process, see Section C in the Appendix. For the *K* selected via this procedure, entropy values were high across all three countries (Canada: 0.93, U.S.: 0.95, Japan: 0.92), and average posterior probabilities of class membership ranged from 0.93 to 0.98 across profiles, which indicates well-separated latent classes.

Bayesian Additive Regression Trees

To address RQ2, which focuses on the most important determinants of climate information separate Bayesian Additive Regression Trees (BART) were estimated to examine the role of a broad set of determinants in predicting membership in different climate information profiles (Chipman et al., 2010). Separate models were fit for each profile using a binary dependent variable contrasting the focal profile against all others. To allow for streamlined prediction of class membership, I assigned each respondent to their modal class assigned by the LCA for these analyses.

To assess H1–H3, which examine whether added variation in epistemic states and domains improves predictive power, I extracted respondents' posterior class membership probabilities from each model specification. Such an approach preserves classification uncertainty by using posterior probabilities from latent class models as predictors, which reduces bias associated with naïve modal class assignment (see Vermunt, 2010). These probabilities were then used as predictors in the BART models alongside additional covariates informed by the literature on each outcome variable. RQ3, which asks how the derived climate information profiles predict relevant outcomes, was investigated using the profiles estimated from the full, expanded specification presented in Table 2 (rows 3 and 4; columns 4 and 5).

BART is particularly well suited for both determining the predictors and outcomes of membership in climate information profiles, as it can accommodate a large number of predictors simultaneously, does not assume linearity or independence between predictors, and naturally handles interactions between them.[6]

[6] Models were estimated using the *dbarts* package in R (Chipman et al., 2010) with default settings of 200 trees, 1000 posterior draws, and a burn-in period of 100 samples.

Results

Climate information profiles across countries

First, I present the results derived from the LCA including expanded epistemic states and domains of climate information. The analyses indicate that climate change information varies substantially across both epistemic states and domains. Figures 1–3 show the climate conception profiles derived from the LCA for each country. Each line corresponds to an epistemic state (*informed*, *uninformed*, or *misinformed*), and each point along the x-axis represents a different domain of climate change conceptions (its existence, causes, impacts, policy responses, and climate science and the climate movement). The y-axis shows the mean value of each epistemic state within the different domains for individuals assigned to the respective profile. As a reminder, respondents were able to score a maximum value of 4 on each epistemic state × domain indicator, which is why the y-axis in the figures ranges from 0–4.

While the results show striking cross-national similarities, they also reveal some country-specific variation in profile composition. Across the three countries, the number of latent profiles is broadly similar, with a five-profile solution ($K = 5$) chosen for Canada and the U.S., and a four-profile solution ($K = 4$) for Japan, based on the model selection procedure outlined above.

An *Informed* profile, characterized by consistently high scores on the informed epistemic state relative to misinformed and uninformed responses across all domains, emerged in all three countries (Panel 1). Although the share of uninformed responses concerning the policy responses and the climate science and climate movement domains was somewhat higher in Japan than in Canada and the U.S., informed responses still constituted the epistemic state with the highest mean value across both domains. Interestingly, across all countries, the mean level

of uninformed responses in the science and movement domains remained at approximately one in four items, indicating that uncertainty is still present even within this profile. These are domains in which media discourse has often been characterized as more skeptical (see Painter et al., 2023). In Japan, this pattern was particularly pronounced, with an average one in four misinformed responses also observed for items corresponding to these domains. While the number of respondents assigned to this profile was substantial across all three countries, it was highest in Canada (n = 443, 27.7%), and slightly lower in the U.S. (n = 362, 22.7%) and Japan (n = 316, 19.8%).

A second recurring profile, labeled *Basic Informed*, also appeared across all three countries (Panel 2). This label was chosen as these respondents are generally correctly informed about well-established aspects of climate change but show lower levels of correct information on more recently contested domains. Specifically, respondents in this profile show similarly high levels of correct information regarding the existence of climate change, somewhat lower levels for causes and impacts, and higher mean uninformed than informed scores for policy responses and the science and movement domains. In terms of the respondents assigned to it by the LCA, this profile constituted the largest profile in both the U.S. (n = 481, 30.1%) and Japan (n = 459, 28.7%), while also representing a substantial share of the Canadian sample (n = 429, 26.8%).

A profile labeled *Existence Informed* emerged in Japan and Canada but not the U.S. (Panel 3). This group shows relatively informed responses regarding the existence of climate change but is predominantly uninformed across all other domains. The profile was somewhat more common in Japan (n = 439, 27.5%) than in Canada (n = 330, 20.6%). The U.S. instead featured a unique profile labeled *New Denial* (Panel 3), whose label follows the terminology used by Nicolosi et al. (2025) when describing a rise in counterclaims questioning the climate solutions and their supporters online. The profile mirrors the *Basic Informed* profile in terms of its information scores regarding climate change's existence, causes, and impacts, but is

distinguished by comparatively elevated misinformation scores regarding policy responses and science and movement. This profile is, however, comparatively small, constituting the profile with the lowest number of respondents within the U.S. sample (n = 174, 10.9%).

Panel 4 shows the *Uninformed* profile, which recurred across all three countries and is characterized by high mean uninformed scores across all domains. Interestingly, this profile was more common in the U.S. (*n* = 401, 25.1%) and Japan (*n* = 385, 24.1%) than in Canada, where it included a comparatively smaller number of respondents (*n* = 232, 14.5%). While one might expect this profile to consist primarily of disengaged respondents selecting the "I don't know which one of the statements is true" response option, only between 41.5% (Japan) and 48.6% (U.S.) of responses in this profile stemmed from "Don't know" selections, which suggests that many reflect genuine low certainty in the selected true or false claims rather than disengagement.

Finally, Panel 5 in Canada and the U.S. depicts the *Misinformed* profile characterized by relatively high levels of confidently held false beliefs across domains. The exception is the responses domain in the U.S., where uninformed responses are somewhat more prevalent than misinformed responses. Compared to other profiles, this group is nonetheless clearly characterized by a higher share of misinformed responses across all domains, although this dominance is less pronounced than the dominance of informed and uninformed responses in their respective profiles. This pattern suggests that even individuals in the misinformed profile retain some accurate knowledge or, at minimum, express lower certainty in some incorrect responses. This pattern is particularly pronounced in Canada, where members of the misinformed profile still answer, on average, approximately one out of four items correctly within each domain. The *Misinformed* profile constituted the smallest group in Canada (*n* = 167, 10.4%) and the second-smallest group in the U.S. (*n* = 180, 11.3%). In Japan, no such profile emerges.

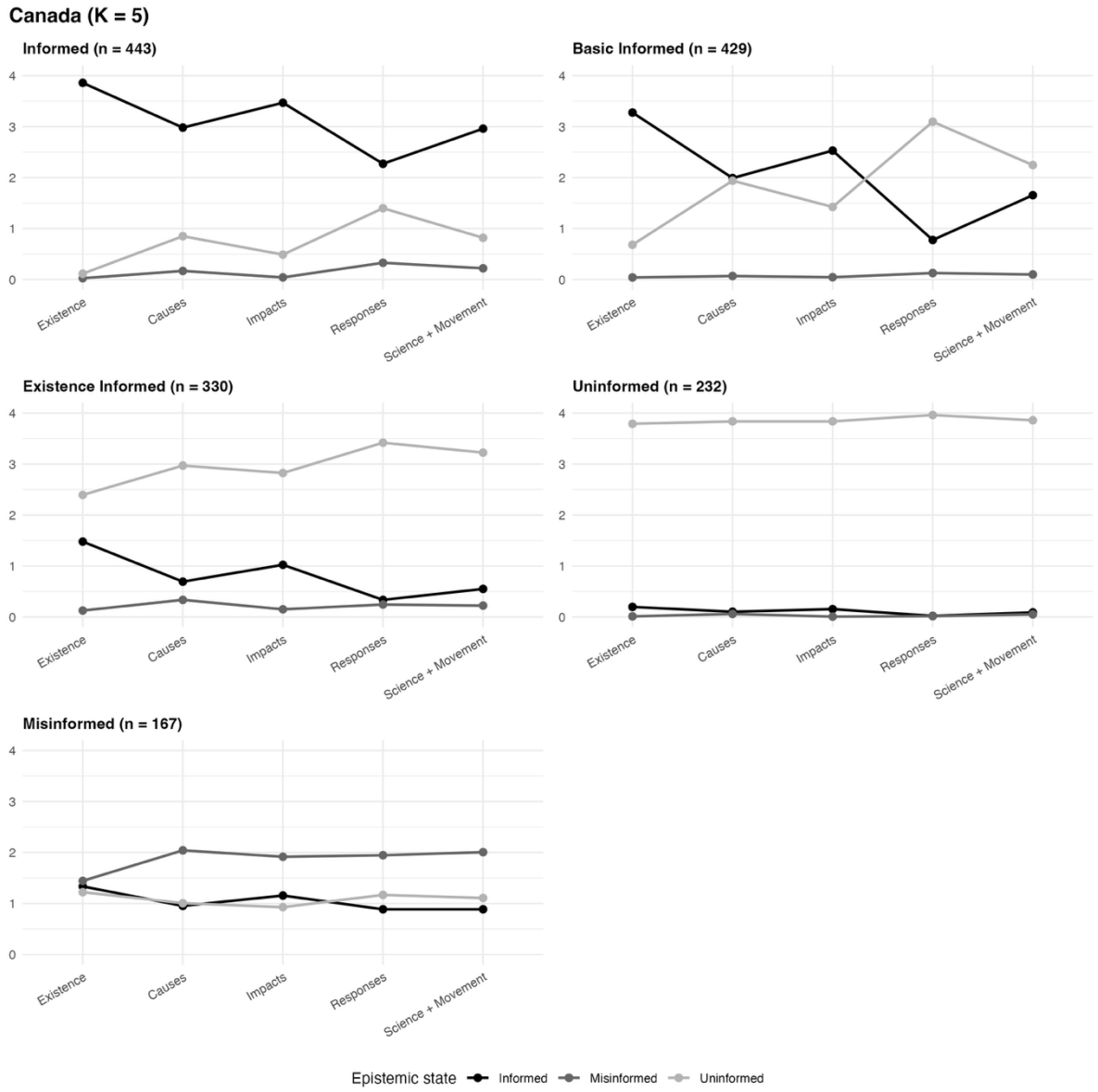


Figure 1: Climate information profiles estimated from LCA (Canada).

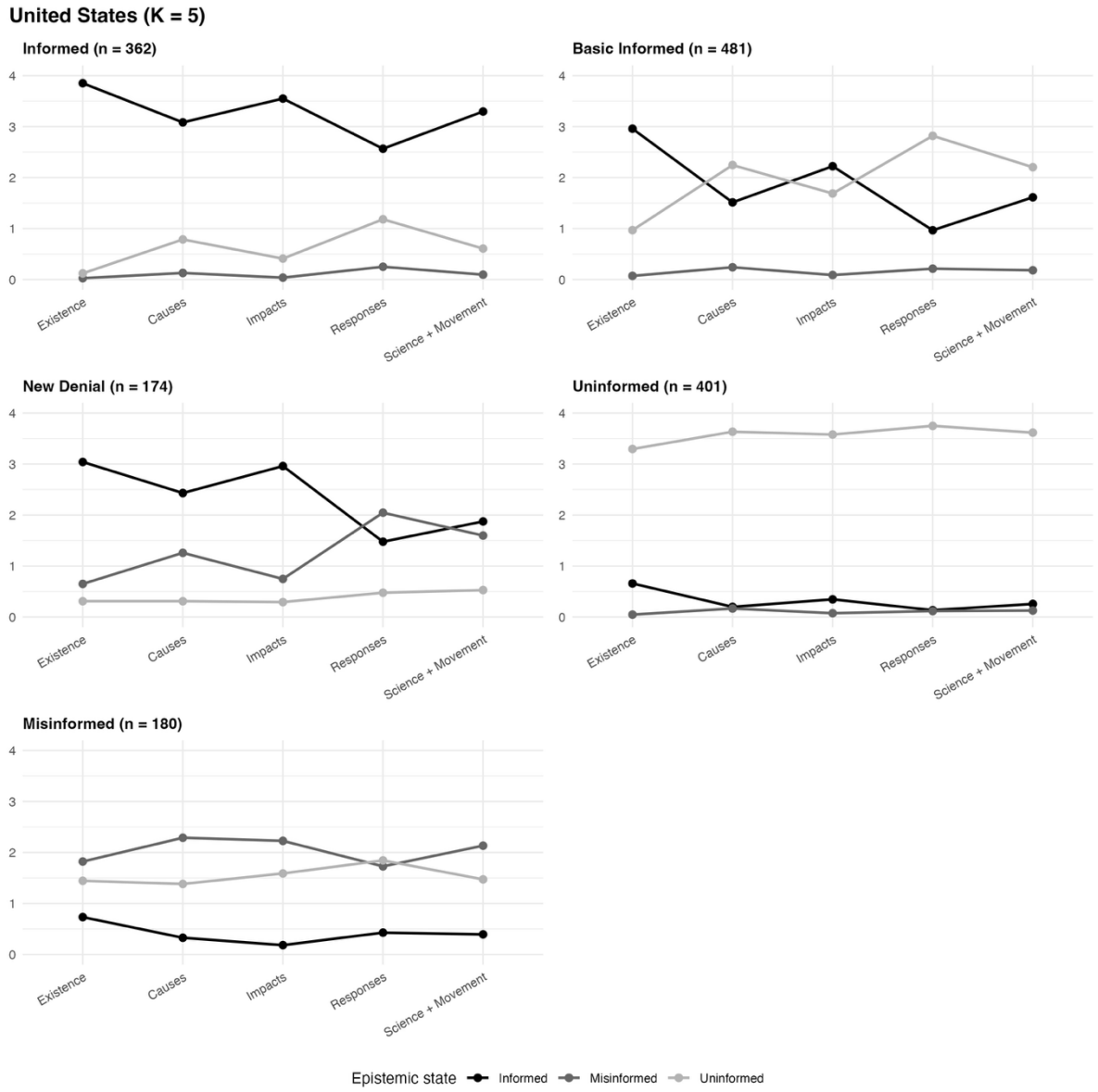


Figure 2: Climate information profiles estimated from LCA (U.S.)

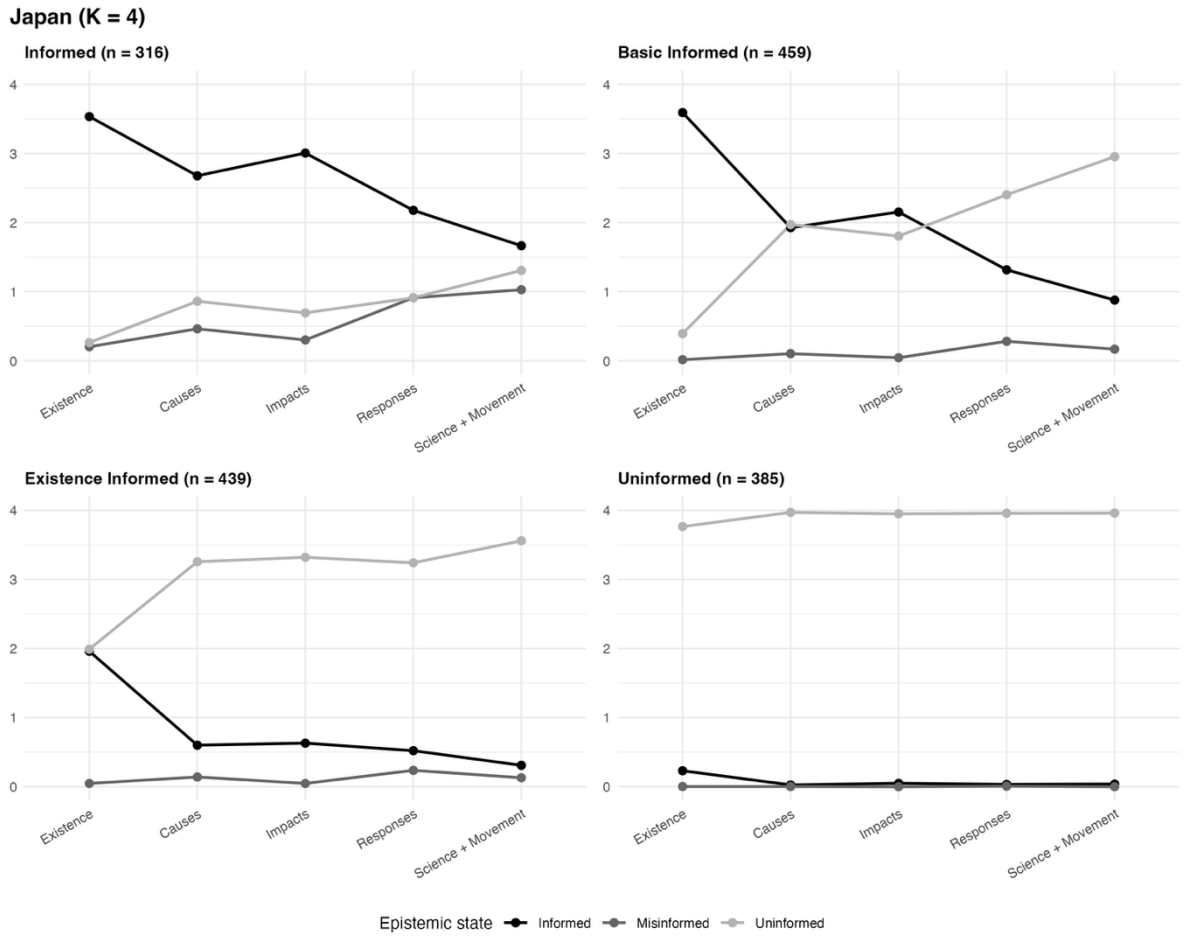


Figure 3: Climate information profiles estimated from LCA (Japan).

Uninformed responses in Japan

A notable pattern that emerges from the cross-country comparison is the generally greater prevalence of profiles characterized by higher shares of uninformed responses in Japan, as compared to Canada and the United States. While an informed profile where informed responses outweigh uninformed and misinformed responses across all domains does exist in Japan, the dominance of informed responses is less pronounced and the share of respondents assigned to this profile is comparatively low. Similarly, no *Misinformed* profile emerges in this setting.

This overall pattern aligns with the argument that, potentially due to lower politicization of climate change in Japan (see Hornsey et al., 2018), public opinion is characterized by

indifference to a comparatively large degree (Kosugi and Baba, 2023). In contrast, in Canada and the United States, a comparatively large and politically salient extractive sector has been associated with the emergence of organized actors and networks that have contributed to the dissemination of climate misinformation in the North American context (Oreskes and Conway, 2011). This may in turn contribute to more polarized information environments around climate change in these settings, which may be associated with both more entrenched correct and inaccurate conceptions of climate change (see e.g., Pennycook, 2023).

A further somewhat tentative explanation is related to culturally patterned response styles in the Japanese context. Specifically, Japanese respondents have been found to select neutral or midpoint response options more frequently than respondents in other national contexts (Chen et al., 1995; Harzing, 2006), a tendency that may be linked to norms emphasizing social harmony and caution in expressing firm positions in survey settings (see Guo and Spina, 2019). While this may reduce the expression of high certainty for both correct and incorrect claims, it may specifically contribute to lower endorsement of incorrect claims perceived whose endorsement is likely to be seen as less socially desirable.

What determines membership in climate information profiles?

While the analyses conducted thus far provide a descriptive overview of climate information in Canada, the U.S., and Japan, a central focus of prior research has been identifying the factors shaping variation in how people understand climate change. To better understand the characteristics associated with profile membership, BART models were used to compare the relative importance of sociodemographic, psychological, climate-related, lifestyle-related, and trust-related factors in predicting membership in each climate conception profile. The dot plot in Figure 4 summarizes the relative importance of predictors from these models across profiles and countries. The plot presents each predictor that exceeded the $1/P$ threshold (where P is the number of predictors) for at least one country within a profile. Exceeding this threshold

indicates that BART assigns more splits to that variable than would be expected if every predictor contributed equally.[7] Specifically, this meant that predictors had to be included in 2.86% of splits for Canada and Japan (where $P = 35$), and 3.03% of splits for the U.S. ($P = 33$) within a given country–profile model in order to be considered meaningful. In Figures 4–6, the circles' sizes indicate relative importance among the selected predictors, which are divided into tertiles based on their inclusion proportions. Because BART models do not directly provide signed coefficients and predictor effects may be non-linear, I also implemented steps to provide readers an overview of each effect's approximate direction. To determine whether a relationship resembled a non-monotonic association, each predictor's partial dependence plot (PDP) was evaluated across 20 equally spaced values between the 10th and 90th percentiles of its observed distribution. Relationships were classified as non-monotonic if the PDP reached a local maximum or minimum within this range and subsequently reversed by more than 50% of the total predicted range before reaching the endpoint. For all other relationships, the direction of the association was determined by comparing the average predicted values in the lowest third and highest third of the 20 PDP values. The circles' colors (grey for non-monotonic effects; blue for positive effects; red for negative effects) indicate the approximated effect direction. Below, results are discussed for the different profiles.

[7] Bleich et al. (2014) note that this threshold may be overly permissive, as BART's tendency to capitalize on chance associations can lead to overfitting and cause predictors unrelated to the outcome to appear important. Because variable importance thresholds are sensitive to correlations among predictors (Luo & Daniels, 2024), which is particularly relevant for the broad predictor set used here, the less stringent 1/P threshold is retained for the exploratory analyses presented here. Additional analyses using two different permutation approaches, one proposed by Bleich et al. (2014) and one put forth by Luo and Daniels (2024), are provided in Section D of the Appendix.

Predictors: High-information profiles

In terms of their predictors, the *Informed* and *Basic Informed* profiles show several important similarities, which may be tied to members' generally higher share of informed responses across domains. They are thus discussed jointly here. Below, Figure 4 shows the predictors that crossed the importance threshold defined by $1/P$ in at least one of the three countries for these two profiles. Across both profiles, the New Ecological Paradigm (NEP) consistently ranked among the top tertile of predictors across all three countries. This aligns with Hornsey et al.'s (2016) large-scale meta-analysis, which identifies environmental worldviews as one of the strongest determinants of accurate climate beliefs. Beyond a strong environmental worldview, greater trust in scientists also predicted membership (see also Ejaz et al., 2024), and with that, a source that is generally expected to communicate scientifically accurate information about climate change. Members of both profiles also tended to perceive greater changes in local summer temperatures, with the exception of the *Informed* profile in Japan.

Despite these similarities, membership in the *Informed* profile is predicted by a broader and more consistent set of value-, worldview-, and trust-related predictors, all pointing in the direction associated with accurate climate beliefs in prior research, than membership in the *Basic Informed* profile. The *Basic Informed* profile, by contrast, appears to consist of respondents who hold relatively accurate climate beliefs without this same breadth of supporting predictors.

This distinction is first reflected in each profile's trust-related predictors. In addition to trust in scientists, which emerged as a consistently relevant predictor for both profiles, membership in the *Informed* profile was predicted by greater trust in international organizations (Canada and Japan) and lower trust in energy companies (Canada and the U.S.). Similarly, while trust in environmentalists was also a relevant predictor in Canada and the U.S. for the *Basic Informed* profile the association is non-monotonic in the U.S., where predicted membership is highest at

moderately high, rather than maximal, levels of trust. The same also applies to trust in scientists in this context. At the same time, despite trust in climate-relevant information sources playing a comparatively weaker role in shaping membership in the *Basic Informed* profile, these respondents also appear to exhibit lower trust in social media. Given that social media constitute a major channel through which climate misinformation circulates (e.g., Nicolosi et al., 2025), this may represent one pathway through which relatively accurate climate beliefs are maintained.

Relatedly, profile members' lower trust in politicians in the U.S., and to a more limited degree in Japan, may reflect evaluations of contemporary political actors' positions on environmental issues at the time of data collection. In the U.S., the Trump administration expressed explicit opposition to several climate policy measures, while in Japan, the governing Liberal Democratic Party has often been associated with comparatively limited climate policy ambition (see Incerti & Lipscy, 2018). This may also explain why trust in politicians does not emerge as an important predictor in Canada, where the ruling Liberal Party, despite some recent shifts away from select climate policies, has historically maintained a stronger association with climate action and emissions-reduction commitments. Taken together, these patterns suggest that the *Informed* profile is characterized by stronger alignment with actors typically associated with climate action, alongside lower trust in actors perceived as less supportive of climate mitigation.

A similar pattern emerges for cultural worldviews, which represented a more relevant and consistent set of predictors for the *Informed* profile than for the *Basic Informed* profile. Consistent with prior research linking cultural worldviews to climate beliefs (e.g., Kahan, 2013), lower individualism predicted membership in the *Informed* profile in the U.S. and Japan, while greater egalitarianism emerged as a positive predictor in Canada and the U.S. A somewhat unexpected finding is that greater values on the hierarchy scale predicted

membership in Japan, while the expected negative association appeared in the U.S. On the other hand, this finding might reflect the fact that the relationship between cultural worldviews and climate beliefs has often been found to exert substantial variation across countries (e.g., Pröpper et al., 2022). In contrast, cultural worldviews showed comparatively limited relevance for the *Basic Informed* profile. The only predictor consistently passing the importance threshold was individualism, which exhibited a non-monotonic relationship across countries. The PDPs indicate that higher levels of individualism were initially associated with greater predicted probability of membership, before reversing direction at approximately 3.5, resulting in an inverted U-shaped relationship. Substantively, this suggests that, across countries, respondents with moderate levels of individualism had the highest predicted probability of membership, whereas membership was less likely at the extremes of the scale. Notably, however, this differs from the *Informed* profile, for which individualism *negatively* predicted membership in the U.S. and Japan.

A final distinction concerns lifestyle-related predictors, although these patterns were more country-specific. In Canada, greater reported importance of emissions-related behaviors, like driving one's car, using single-use items, and eating meat, was associated with a lower probability of membership in the *Informed* profile. Conversely, greater importance attributed to driving and long-distance vacations abroad *positively* predicted membership in the *Basic Informed* profile in this setting. This further suggests that the *Informed* profile is characterized by a broader environmental orientation, in which climate beliefs are accompanied by greater concern about environmentally consequential lifestyle choices. It should be pointed out, however, that in Japan, use of single-use items and long-distance vacations positively predicted membership in both high-information profiles. The pattern was less consistent in the United States, although use of single-use items emerged as an important negative predictor for the *Basic Informed* profile.

Overall, these findings suggest that while both profiles capture respondents with relatively high levels of climate knowledge and environmental concern, the *Informed* profile is both more consistently and more substantively embedded within a broader psychological framework that includes many of the factors commonly associated with accurate climate beliefs.

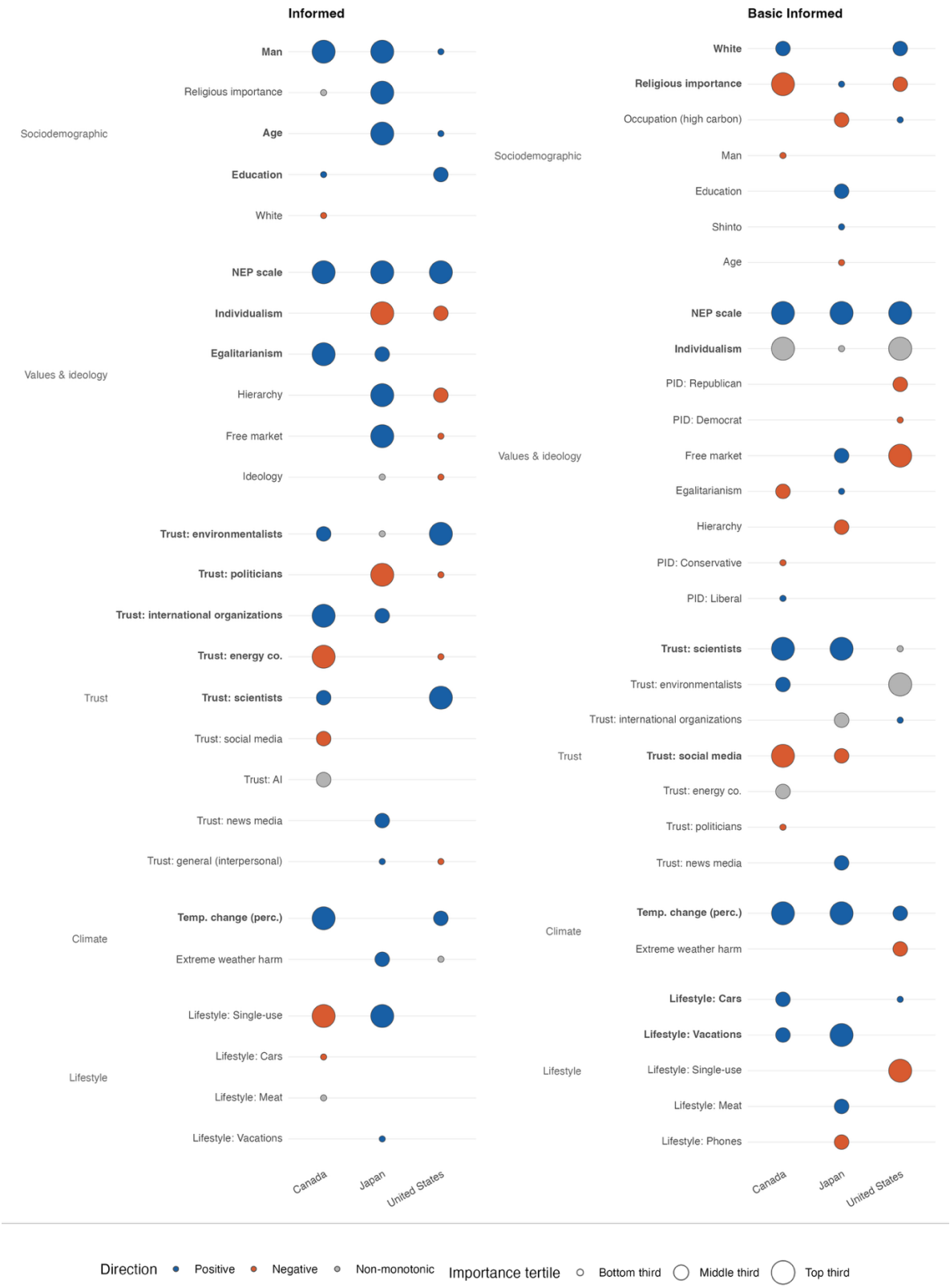


Figure 4: Important predictors of climate information profiles characterized by high levels of informed responses.
Note: Predictors that crossed the importance threshold in two or more countries are highlighted in bold.

Predictors: Low-information profiles

Figure 5 shows the most important predictors for the three climate information profiles characterized by lower levels of informed responses across domains: These include the universally appearing *Uninformed* profile as well as the *Existence Informed* (Canada and Japan) and the *Misinformed* (Canada and the U.S.) profiles, which appeared in two out of three settings. At first glance, the *Uninformed* profile appears to be somewhat the reverse of the high-information profiles in terms of its most important predictors. Notably, the probability of profile membership decreased with greater NEP values across all three countries, although this predictor was used comparatively less often in the Canadian case. Similarly, consistently higher egalitarianism was associated with a lower probability of profile membership. Another consistent predictor was lower trust in environmentalists across all three countries, as well as lower trust in scientists in Canada and the U.S., which emerged as relatively consistent predictors of both high-information profiles. Members of this profile also perceived fewer changes in local summer temperatures in Canada and the U.S., and reported lower experienced harm from extreme weather events than members of other profiles.

Yet, a closer examination suggests that the *Uninformed* profile, similar to the *Basic Informed* profile among the high-information profiles, is less embedded in a consistent ideological worldview. The effect of ideology is highly country dependent, with left-wing ideology emerging as a strong predictor in Canada and right-wing ideology predicting membership in the U.S., while ideology did not emerge as a relevant predictor in Japan. Similarly, apart from lower levels of hierarchy, none of the cultural worldview variables exerted a consistent effect across countries. In fact, hierarchy, which is often associated with lower levels of accurate climate beliefs (see Hornsey et al., 2016), was a negative predictor, although not as frequently used, in the U.S., and exerted a nonmonotonic relationship with profile membership in Japan. Individualism, on the other hand, only emerged as a predictor in Canada. There, its positive

effect on profile membership still sharply dropped once respondents reached a 4 on the 5-point index.

The role of lifestyle variables is similarly incongruent with the idea of a coherent anti-environmental worldview. Long-haul vacations showed an inverted U-shape relationship in Canada, while car use emerged as a negative predictor. In the U.S., only single use items showed a non-monotonic relationship that passed the threshold. This pattern of importance of emissions-heavy lifestyles was greatest in Japan, where long-haul vacation, meat consumption and single-use items emerged as negative predictors of profile membership. Overall, this pattern indicates that membership in the *Uninformed* profile may be associated with a weaker environmental worldview and lower exposure to the effects of climate change. The substantial cross-country variation in ideological, cultural worldview, and lifestyle predictors suggests that this profile is not primarily characterized by a coherent anti-environmental worldview, however. Based on the patterns observed here, it remains unclear whether the profile's predictors reflect some degree of rejection of environmental ideas and values, or whether they merely reflect disengagement.

Out of the non-universal profiles, the *Existence Informed* profile emerging in Canada and Japan seems to most closely align with the former. Interestingly, younger age and identifying as a woman emerged as consistent sociodemographic predictors in both countries. While this profile is characterized by lower trust in international organizations and scientists as sources of pro climate information in both countries where it appears, these are the only consistent predictors that would point toward a climate related dimension, rather than a broader pattern of institutional skepticism. Especially in Japan, lower trust in institutions and established sources of authority appears to be a more central theme of this profile. In addition to lower trust in international organizations and scientists, members of this profile also showed lower interpersonal trust, lower trust in the news, and placed lower importance on religion. Taken

together, these predictors may indicate a broader pattern of lower institutional attachment or skepticism toward established sources of information and authority.

Cultural worldviews were also seemingly less relevant, emerging as important predictors only in Canada. In particular, egalitarianism, although not frequently used, and moderate levels of individualism predicted membership in this setting. That being said, in both countries, members of this profile were more likely to align with the political right, which in both settings opposes climate action. Specifically, right-wing ideology predicted membership in Japan, and Conservative Party identification predicted membership in Canada, while support for the center left Constitutional Democratic Party (CDP) emerged as a negative predictor in Japan. Moreover, the NEP emerged as a moderately important negative predictor of membership in both countries. These orientations again did not appear to extend into a fully coherent ideological worldview, however.

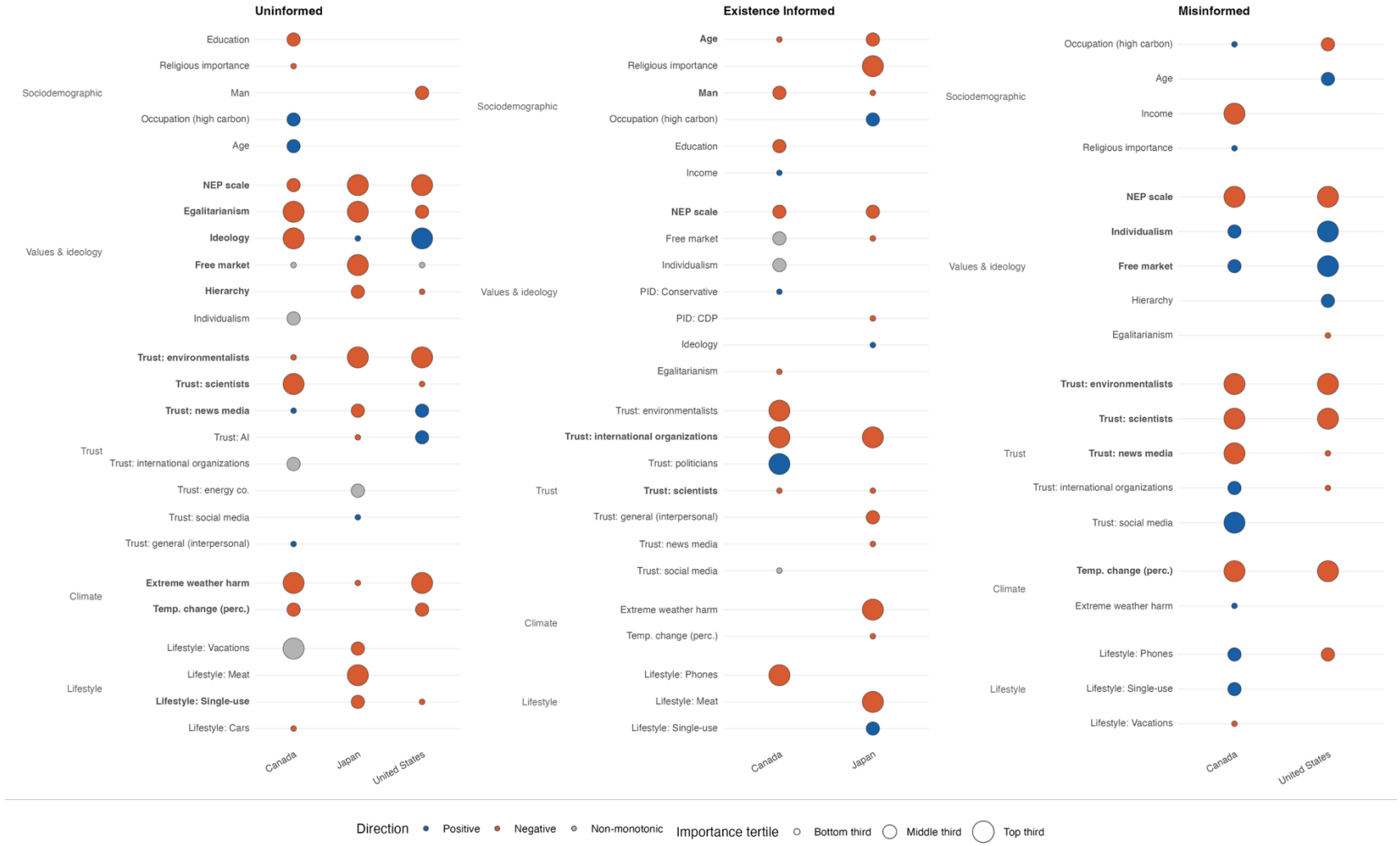


Figure 5: Important predictors of climate information profiles characterized by low levels of informed responses.

Note: Predictors that crossed the importance threshold in at least two countries are highlighted in bold.

Contrary to what was found for the low-information profiles discussed previously, the *Misinformed* profile, which appears in Canada and the U.S., appears to be predicted by a broader set of ideological worldviews and belief systems commonly associated with lower climate acceptance. In this regard, the profile somewhat mirrors the *Informed* profile, as membership appears to be structured by a coherent set of values. Across both countries, the NEP emerged as a top tertile negative predictor, while individualism and free market values emerged as positive predictors. Members of this profile also expressed lower trust in environmentalists, scientists, and news media, while in Canada they additionally showed greater trust in social media. Especially in Canada, this pattern thus suggests that the profile may not simply be characterized by limited access to climate information, but rather by embeddedness in alternative information environments that may challenge mainstream climate narratives (see Nicolosi et al., 2025). In both countries, members of this profile also tended to report lower perceived increases in local summer temperatures. Lifestyle-related factors were inconsistent across the two countries: In Canada, buying new phones and single use items emerged as relevant predictors, while members of the profile indicated long haul vacations to be less important. Rather than reflecting a pro-environmental orientation, this association may partly reflect the importance of lower income as a predictor in this setting, as lower income levels may reduce the relevance of costly long-haul travel. In the U.S., the only important lifestyle related predictor was lower importance placed on buying new phones. Given the lack of other lifestyle predictors pointing in the same direction, however, this association does not provide clear evidence of a broader environmental lifestyle orientation.

Predictors: New Denial

Conversely, the U.S.'s unique *New Denial* profile, was the profile for which such lifestyle-related predictors appeared to play the most central role across profiles, which collectively emerged as the clearest predictor block for membership in this profile (see Figure 6). Members

of this profile tended to place greater importance on long-distance vacations, meat consumption, buying new phones, and the use of single use items. The NEP also emerged as a weak negative predictor, although it was included in the lower tertile of splits relative to other predictors above the threshold. As with other profiles characterized by lower information in certain domains, hierarchy was also a predictor of membership in this profile, although it also ranked in the bottom tertile of predictor importance. Individualism, which was the most-used ideological predictor for this profile, exerted a non-monotonic relationship with profile membership. Specifically, the predicted probability of membership first increases before dropping sharply at values above approximately 4.5 on the 5-point scale. Combined with the high importance of lifestyles for predicting this profile, this greater importance of individualism makes sense, given the intuitive link between this worldview and a stronger focus on one's own lifestyles and priorities. A somewhat unexpected pattern is the absence of trust in social media as an alternative information source, despite its role in circulating misinformation on climate responses and climate science and movement (Nicolosi et al., 2025), which members in this profile tended to endorse at higher rates. While trust in news media was a negative predictor, there is no evidence of a substitution effect toward social media.

Overall, these findings invite further reflection on the relationship between these determinants and the distribution of climate information across different domains in this profile. Given that these individuals' acceptance of misinformation does not appear to be strongly rooted in coherent ideological worldviews, and that they nevertheless report trust in environmentalists as well as having experienced harm from extreme weather events first-hand, misperceptions are highly unlikely to relate to the core scientific foundations of climate change, like its existence, causes, or impacts. The cognitive tension arising from awareness of these foundations alongside carbon intensive lifestyles (Hornsey and Lewandowsky, 2022), however, may instead be expressed through endorsement of false or misleading claims in

alternative domains. Specifically, the evidence base in domains related to climate responses and the climate movement tends to be more contested, and counterclaims are more salient in the media (Painter et al., 2023; Nicolosi et al., 2025), which might make them easier to accept for individuals with an otherwise strong understanding of climate change. As such, these narratives may help sustain carbon intensive lifestyles by making continued engagement in these behaviors psychologically easier in light of awareness of their environmental consequences.

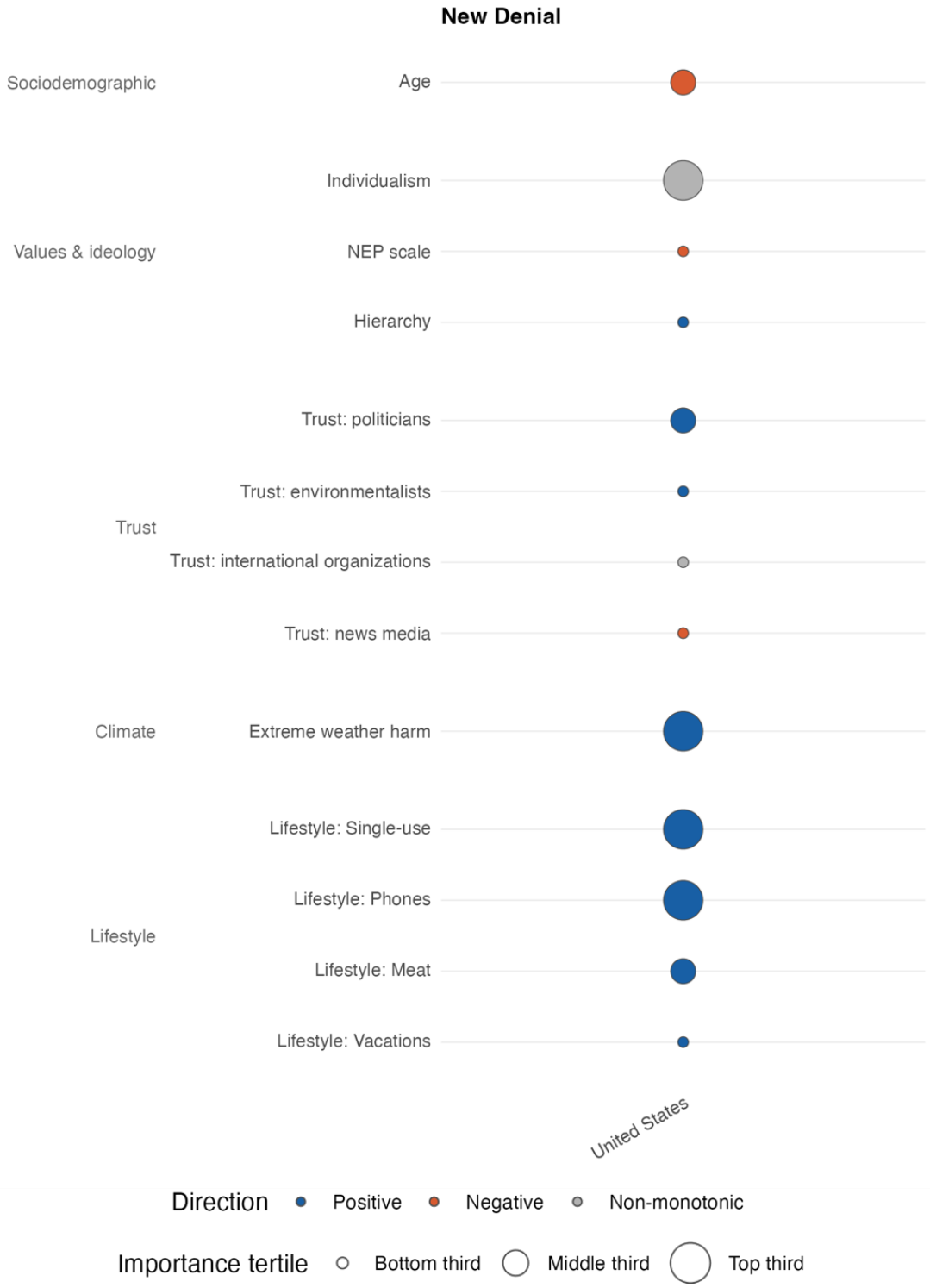


Figure 6: Important predictors of the *New Denial* profile.

Climate information profiles as predictors of relevant outcomes

In light of the often evoked negative effects of inaccurate climate beliefs on climate action (Treen et al., 2020), another major focus of prior research has been to understand how climate information might predict climate-related outcomes. While the analyses were conducted for all profiles, Figure 7 below provides insights into this question for the profiles that emerged across all three countries (*Informed*, *Basic Informed*, *Uninformed*). A supplementary plot depicting the results for the universal profiles and the remaining profiles is provided in Section E of the Appendix. Each panel shows the predicted associations between the membership in each profile and a specific outcome, with 95% credible intervals. As described above, BART models incorporating respondents' posterior profile membership probabilities and relevant covariates were estimated for each outcome. To visualize the estimated effect of each profile, predicted values were obtained by setting the posterior probability of membership in the focal profile to one and all others to zero while holding all other covariates at their observed values and averaging predictions across respondents. The resulting estimates thus reflect the predicted outcome for a prototypical member of each profile, averaged over the observed covariate distribution of the full sample. Estimates for the different countries are distinguished by marker shape and color: light grey circles for Canada, dark grey squares for the U.S., and black triangles for Japan. All four outcomes are indexes with a range from 1–5.

The plots reveal substantial differences in the associations between the universal profiles and these outcomes. Specifically, profiles that are associated with greater levels of accurate information across a wider set of domains consistently scored higher on climate concern, climate policy support, climate efficacy and climate-related behaviors. In this sense, the profiles can be ordered along a continuum according to their associations with these outcomes, ranging from the *Informed* profile, which consistently scored highest across outcomes, through the *Basic Informed* profile, to the *Uninformed* profile, which exhibited the lowest levels across

outcomes and countries. These differences are moderate in magnitude but substantively meaningful given the five-point scales used to measure the outcomes. Averaged across the three countries, differences between the two profiles at the opposite ends of this continuum were 0.487 for climate efficacy, 0.638 for policy support, 0.737 for climate-related behaviors, and 0.824 for climate concern. The *Basic Informed* profile lies between the *Informed* and *Uninformed* profiles, with differences between the *Informed* and *Basic Informed* profiles generally smaller than those between the *Basic Informed* and *Uninformed* profiles. Interestingly, the patterns observed here are highly consistent with a knowledge-deficit approach to understanding climate-related outcomes (Grant, 2023), with pro-climate attitudes and behaviors increasing with greater levels of accurate climate information across a wider set of domains, and vice versa.

While the general logic of this continuum holds across countries, some notable differences emerged between countries. Specifically, the degree to which a profile is characterized by accurate information appears to play an especially important role in the U.S., where differences between the *Informed* and *Uninformed* profiles were most pronounced (0.637 for climate efficacy; 0.782 for policy support; 0.855 for behaviors; 0.900 for climate concern). In Canada, the separation between the *Informed* and *Uninformed* profiles was similar, although somewhat weaker (0.567 for efficacy; 0.648 for behaviors; 0.718 for policy support; 0.769 for climate concern). Interestingly, the slightly weaker contrasts observed in Canada relative to the U.S. appear to be driven by higher predicted outcome levels among members of the *Informed* profile in the U.S., rather than by more favorable outcomes among *Uninformed* respondents in Canada. By contrast, differences between these profiles, especially for efficacy and policy support, were substantially less pronounced in Japan, (0.257 for climate efficacy; 0.341 for policy support; 0.781 for behaviors; 0.808 for climate concern). Consistent with this pattern, while Japanese respondents in the *Informed* profile expressed the highest levels of climate concern across all

countries and profiles, they also exhibited the lowest levels within the *Informed* profile for policy support, efficacy, and behavior. Relatedly, while the *Basic Informed* profile is consistently positioned between the *Informed* and *Uninformed* profiles in Canada and the U.S., membership in this profile is not credibly different from the *Informed* profile with respect to climate concern, policy support, and efficacy in Japan. This suggests that, in Japan, additional differences in accurate climate information may have less influence on these outcomes than in the other countries. This again aligns with the idea that, although the Japanese population tends to generally express concern about climate change and is supportive of climate action, substantial movement beyond the status quo is not a salient consideration (Brechin and Bhandari, 2011).

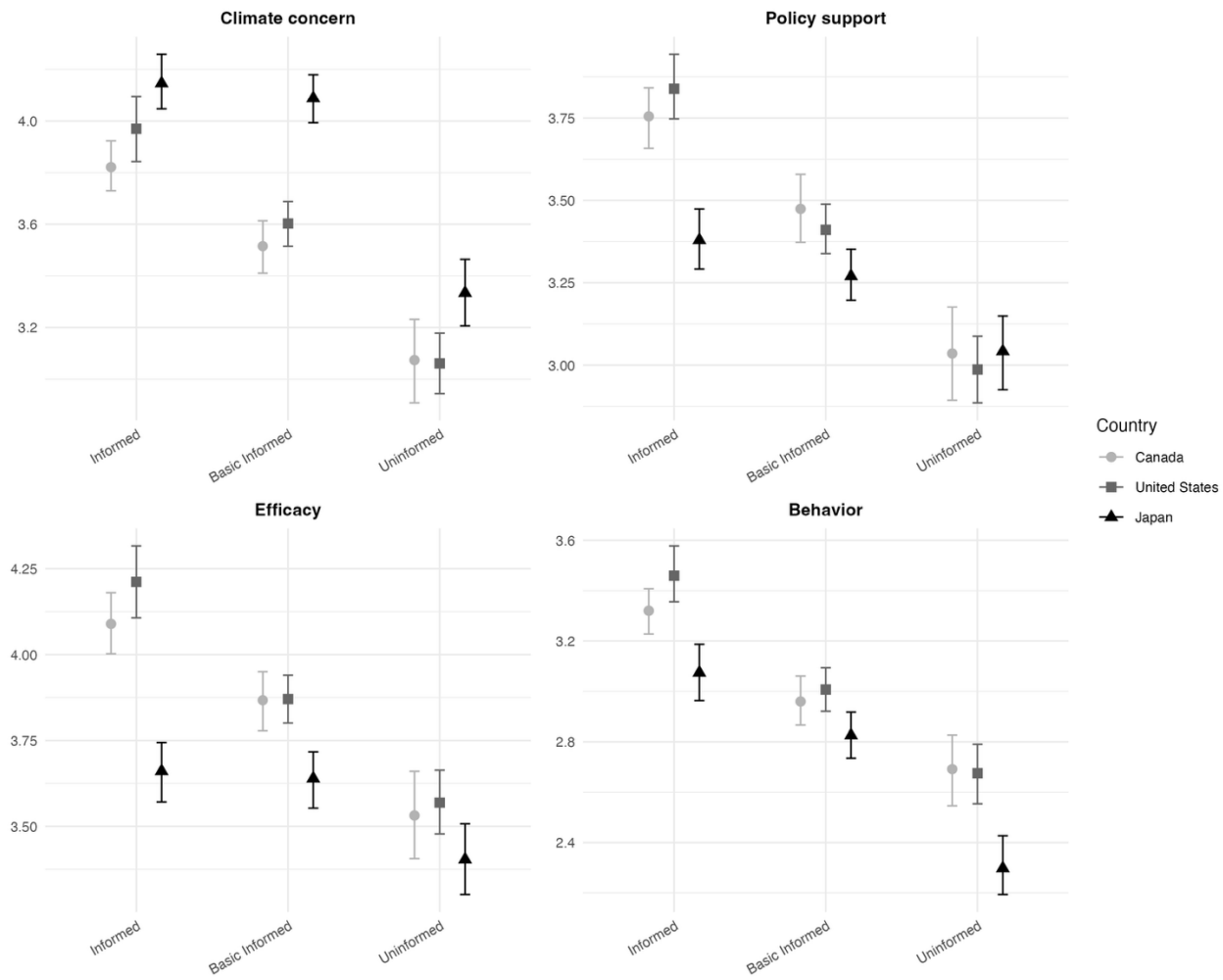


Figure 7: Associations between posterior probability of profile membership and outcomes estimated using BART (posterior means with 95% credible intervals)

Non-universal profiles and outcomes

Although detailed plots depicting the associations between membership in the remaining, non-universal climate information profiles are presented in Section E of the Appendix, I summarize general patterns in the predicted effects of profile membership below. Overall, these patterns fit well within the logic of the continuum described above. In particular, as expected given the higher levels of information regarding the existence dimension among members of this profile, the *Existence Informed* profile in Canada and Japan tends to show somewhat higher levels across the four outcome variables than the *Uninformed* profile. At the same time, with the exception of climate concern in Japan, membership in the *Existence Informed* profile was not credibly distinguishable from the *Uninformed* profile with respect to the remaining outcomes.

Interestingly, membership in the *Misinformed* profile was generally associated with even lower levels on the four outcomes than membership in the *Uninformed* profile, a pattern that was particularly pronounced in the U.S. As the profile occupying the lowest end of the continuum, differences between the *Informed* and *Misinformed* profiles ranged from 1.110 for climate efficacy to 1.500 for climate concern. Differences between the *Misinformed* and *Uninformed* profiles were also credibly different for all outcomes except climate-related behaviors, ranging from 0.437 for climate efficacy to 0.587 for climate concern. In Canada, the same tendency is still generally present, although it is somewhat less pronounced than in the U.S. Notably, the *Misinformed* profile is associated with unexpectedly high levels of self-reported climate-related behaviors in Canada and is only around 0.236 below the informed profile. For efficacy, the *Uninformed* and *Misinformed* profiles are effectively tied at the lower end of the spectrum, whereas only slightly lower values emerge for the *Misinformed* profile for climate concern and policy support. Especially in the U.S., this pattern thus extends beyond a simple knowledge-deficit perspective: while a lack of information may lead to lower levels of these outcomes, respondents holding inaccurate information tend to exhibit even less favorable outcomes than

those who are merely uninformed. While the low levels of pro-climate outcomes among *Misinformed* respondents are concerning for public support of necessary climate action, these findings also point to a potentially optimistic conclusion. Since this profile is comparatively small in both Canada (n = 167) and the U.S. (n = 180), a larger share of respondents falls into the *Uninformed* profile (n = 232 in Canada; n = 401 in the U.S.; n = 385 in Japan) which suggests that many individuals may be less entrenched in their views regarding both climate-related knowledge and attitudes. This suggests that a substantial share of the public may remain open to climate action, both at the governmental level and in their daily lives.

Finally, the U.S.'s unique *New Denial* profile is associated with surprisingly high levels on all outcome variables. At a predicted estimate of 3.590, it is the profile with the highest level of self-reported climate-related behaviors in the U.S., although the estimate is uncertain and the difference between the *Informed* profile is statistically indistinguishable from zero. With the exception of climate concern, where the estimate for membership in the *Basic Informed* profile is slightly higher, point estimates for this profile are the second highest across the remaining outcomes. While this pattern is somewhat unexpected, it suggests an interesting insight regarding the role of epistemic states within profiles in predicting climate-related outcomes. Specifically, the presence of additional accurate information in this profile may offset the potential additional negative effect of misinformed responses over mere uninformed responses. Although this profile also shows elevated levels of misinformed responses on the policy responses and science and movement dimensions, it contains a higher share of informed responses on these domains than the *Basic Informed* profile, where uninformed responses are more prevalent.

Differences in predictive performance

The prior analyses relied on the conceptualization of climate information advanced in this study, which conceptualizes climate change information as distributed across three distinct, certainty-informed epistemic states (informed, misinformed, and uninformed) and five domains (existence, causes, impacts, policy responses, and science and movement). It has not yet been established, however, whether this expanded conceptualization truly offers a more informative characterization of climate information than approaches used in prior research. As described in the *Data and Methods* section, BART models including differing operationalizations of climate information were estimated to test H1–H3. Table 3 below shows differences in predictive performance for models using the proposed indicator set (column 4) used in this study to various simpler alternatives (columns 1–3).

In terms of H1, which compared a naïve distinction of epistemic states between inaccurate and accurate beliefs to one incorporating the three distinct epistemic states proposed in this study, the results were quite clear. Only in three of twelve country-outcome pairings (policy support in Canada; efficacy and policy support in Japan) did the specification including the certainty-blind dichotomous epistemic states outperform the expanded model incorporating the three certainty-informed epistemic states. In these cases, the differences in RMSE were modest, and ranged between 0.63% and 1.75%. The remaining nine comparisons showed an average improvement of 2.32% in favor of the full epistemic states specification. Overall, these results support H1.

The findings were similar for H2, which concerned improvements related to the inclusion of an expanded set of domains of climate information over ones merely covering climate change's existence and causes. RMSE for BART models using the expanded set of domains was lower for 9 out of the 12 country–outcome pairings, with an average improvement of 2.46% for these comparisons. Again, similar to what was observed for improvements in predictive performance

associated with expansions in epistemic states tested as part of H1, the results were somewhat weaker in Japan than in the two North American settings. In Japan, models incorporating profiles derived from the preferred solution were outperformed by the constrained-domains solution when predicting climate concern and policy support. Although these losses were somewhat minimal (1.00% on average across these two outcomes), gains associated with the preferred solution were also generally smaller in Japan when it did win (1.16% in Japan; compared to 2.54% in Canada and 2.33% in the U.S.). Irrespective of the magnitude of improvement in predictive performance, these results provide largely consistent support for H2, however.

As may be expected based on the results presented thus far, H3, which proposed that combining expanded conceptualizations of epistemic states and domains of climate change would improve predictive performance compared to a constrained solution on both dimensions was also supported. While efficacy and policy support again represent two exceptions in Japan, the preferred solution again outperformed the simpler models for 10 out of 12 comparisons, and thus, in a large majority of comparisons. The average improvement in RMSE across these country-outcome pairings was 4.14%, with the highest value observed for policy support in the U.S. (7.07%). Again, the margins by which the preferred solution was outperformed in the two Japanese pairings were also relatively small (0.52% on average). While the improvements associated with the preferred solution are modest, this is somewhat expected given that the profile indicators are included alongside an already substantial set of established predictors (e.g., sociodemographic characteristics, values, and trust) in each BART model. As a result, less room is left for the profile specifications alone to substantively move the needle on predictive performance. When additional predictors are excluded, the average improvement in RMSE roughly doubles.

	H1 (dichotomous epistemic states, full domains)	H2 (full epistemic states, existence and causes domains)	H3 (dichotomous epistemic states, existence and causes domains)	Proposed specification (full epistemic states, full domains)
Canada				
Behavior	0.732	0.735	0.734	**0.718**
Climate concern	0.731	0.745	0.752	**0.719**
Efficacy	0.554	0.559	0.567	**0.550**
Policy support	**0.633**	0.655	0.660	0.637
Japan				
Behavior	0.716	0.702	0.730	**0.687**
Climate concern	0.705	**0.674**	0.709	0.684
Efficacy	**0.546**	0.553	0.551	0.552
Policy support	**0.571**	0.578	0.576	0.581
United States				
Behavior	0.782	0.776	0.793	**0.757**
Climate concern	0.790	0.797	0.818	**0.776**
Efficacy	0.554	**0.550**	0.564	0.552
Policy support	0.632	0.634	0.651	**0.605**

Table 3: Comparison of predictive performance across LCA specifications by countries and outcomes.
Note: For each outcome within each country, the model with the lowest RMSE is shown in **bold.**

Conclusion and discussion

In this study, I have mapped variation in climate information and its determinants by considering epistemic variation across informed, misinformed, and uninformed responses along five salient dimensions of climate change, drawing on data from three heterogeneous cases: Canada, the U.S., and Japan. A central result is that individuals' climate information is more complex than often assumed by prior research. Specifically, I have identified three universal climate information profiles appearing across countries: an *Informed* profile, a *Basic Informed* profile and an *Uninformed* profile, characterized by different degrees of informed responses across domains of climate conceptions. An *Existence Informed* profile whose members tended to be informed about the existence of climate change, but uninformed about other elements also emerged in Japan and Canada, while a *Misinformed* profile with consistently high levels of misinformation appeared in Canada and the U.S. Finally, a *New Denial* profile with generally high levels of informed responses concerning the fundamental domains of the existence, causes and impacts of climate change, but with greater levels of misinformation regarding political responses and climate science and the climate movement emerged uniquely in the U.S. context.

I subsequently investigated the importance of various predictors capturing respondents' sociodemographic characteristics, their values and ideology, trust in information sources, personal exposure to climate change, and emissions-heavy lifestyles using Bayesian Additive Regression Trees (BART) models. These analyses revealed that the determinants of profile membership were highly profile-specific, with different combinations of values, trust, ideology, sociodemographic characteristics, and lifestyle-related factors shaping membership in each. While an ecological worldview predicted membership across all profiles, its importance was particularly pronounced for the *Informed* and *Misinformed* profiles, which occupy opposite ends of the epistemic continuum. Moreover, a specific combination of

elements commonly associated with climate information, such as cultural worldviews (Kahan, 2013) and trust in specific information sources (Ejaz et al., 2024), further distinguished these poles from each other.

Finally, I incorporated posterior probabilities of profile membership into a set of BART models predicting four relevant climate outcomes: climate concern, policy support, climate efficacy, and pro-climate behavior. Profiles characterized by higher levels of information were generally associated with higher levels across all four outcomes, with the *Informed* and *Misinformed* profiles again emerging as the two endpoints, despite some country-specific variation. These findings suggest that an expanded conceptualization of climate information, incorporating both certainty-informed epistemic states and a broader range of climate domains, captures meaningful variation in climate outcomes. Consistent with this interpretation, preregistered hypothesis tests confirmed that this expanded conceptualization generally improved predictive performance relative to simpler conceptualizations. Importantly, this suggests that prior approaches may offer an incomplete, and potentially biased, account of the associations between climate information and relevant climate outcomes.

Despite these contributions, this study is subject to several limitations. First, the selection of an optimal number of profiles K in LCA is typically based on a combination of fit indicators and subjective theoretical evaluation. To allow for comparability across specifications for testing the pre-registered hypotheses, K was selected at the point of strongest deceleration in BIC improvements. While this is a more objective criterion, it may miss substantively meaningful patterns revealed by closer qualitative inspection of alternative solutions.

Another limitation concerns the role of profiles in predictive models, where it is challenging to separate the role of epistemic states in specific domains from their cumulative impact. One could, for instance, imagine that members of profiles characterized by lower levels of information regarding responses to climate change (i.e., the *Basic Informed*, *Existence*

Informed, and *New Denial* profiles) will express lower support for policy solutions for that reason. These middling profiles, despite lower overall information, consistently show higher levels of information across the fundamental domains of existence, causes, and impacts of climate change. In contrast, no profile exhibits comparatively higher information in the responses and science and movement domains. This makes it impossible to disentangle whether differences in outcomes, compared to the *Informed* profile, where accurate information is dominant across all domains, are driven by domain-specific content or by the *overall breadth* of accurate information.

Finally, observational data naturally can only reveal so much about the true characteristics of members in different profiles. This is particularly true for uninformed responses, which are difficult to interpret unambiguously. In this study, I have conceptualized this as an epistemic state characterized by a lack of information. Yet, such responses might also reflect genuine skepticism, particularly regarding fundamental elements like the existence and causes of climate change (Haltinner & Sarathchandra, 2021). Future research could further probe the reasons for uninformed responses through, for instance, follow-up items targeting the nature of expressed uncertainty. In addition, similar to the pioneering work of Haltinner and Sarathchandra (2021), mixed-methods approaches may shed further light on the climate information held by profile members, the mechanisms through which predictors shape profile membership, and how variation in information influences important climate outcomes.

References

Bergquist, M., Nilsson, A., Harring, N., & Jagers, S. C. (2022). Meta-analyses of fifteen determinants of public opinion about climate change taxes and laws. *Nature Climate Change*, *12*(3), 235–240. https://doi.org/10.1038/s41558-022-01297-6

Bleich, J., Kapelner, A., George, E. I., & Jensen, S. T. (2014). Variable selection for BART: An application to gene regulation. *The Annals of Applied Statistics*, *8*(3). https://doi.org/10.1214/14-AOAS755

Bostrom, A., Hayes, A. L., & Crosman, K. M. (2019). Efficacy, action, and support for reducing climate change risks. *Risk Analysis*, *39*(4), 805–828. https://doi.org/10.1111/risa.13210

Boulianne, S., & Belland, S. (2022). Climate denial in Canada and the United States. *Canadian Review of Sociology/Revue Canadienne de Sociologie*, *59*(3), 369–394. https://doi.org/10.1111/cars.12388

Boussalis, C., & Coan, T. G. (2016). Text-mining the signals of climate change doubt. *Global Environmental Change*, *36*, 89–100. https://doi.org/10.1016/j.gloenvcha.2015.12.001

Bray, B. C., Lanza, S. T., & Tan, X. (2015). Eliminating Bias in Classify-Analyze Approaches for Latent Class Analysis. *Structural Equation Modeling: A Multidisciplinary Journal*, *22*(1), 1–11. https://doi.org/10.1080/10705511.2014.935265

Brechin, S. R., & Bhandari, M. (2011). Perceptions of climate change worldwide. *WIREs Climate Change*, *2*(6), 871–885. https://doi.org/10.1002/wcc.146

Busch, T., & Judick, L. (2021). Climate change—That is not real! A comparative analysis of climate-sceptic think tanks in the USA and Germany. *Climatic Change*, *164*(1–2), 18. https://doi.org/10.1007/s10584-021-02962-z

Capstick, S. B., & Pidgeon, N. F. (2014). What is climate change scepticism? Examination of the concept using a mixed methods study of the UK public. *Global Environmental Change*, *24*, 389–401. https://doi.org/10.1016/j.gloenvcha.2013.08.012

Carroll, W. K., Daub, S., & Gunster, S. (2022). Regime of obstruction: Fossil capitalism and the many facets of climate denial in Canada. In D. Tindall, M. C. J. Stoddart, & R. E. Dunlap (Eds.), *Handbook of Anti-Environmentalism*. Edward Elgar Publishing. https://doi.org/10.4337/9781839100222.00021

Chen, C., Lee, S., & Stevenson, H. W. (1995). Response Style and Cross-Cultural Comparisons of Rating Scales Among East Asian and North American Students. *Psychological Science*, *6*(3), 170–175. https://doi.org/10.1111/j.1467-9280.1995.tb00327.x

Chipman, H. A., George, E. I., & McCulloch, R. E. (2010). BART: Bayesian additive regression trees. *The Annals of Applied Statistics*, *4*(1), 266–298. JSTOR.

Chryst, B., Marlon, J., Van Der Linden, S., Leiserowitz, A., Maibach, E., & Roser-Renouf, C. (2018). Global Warming's "Six Americas Short Survey": Audience Segmentation of Climate Change Views Using a Four Question Instrument. *Environmental Communication*, *12*(8), 1109–1122. https://doi.org/10.1080/17524032.2018.1508047

Clifford, S., & Jerit, J. (2016). Cheating on political knowledge questions in online surveys: An assessment of the problem and solutions. *Public Opinion Quarterly*, *80*(4), 858–887. https://doi.org/10.1093/poq/nfw030

Clifford, S., Kim, Y., & Sullivan, B. W. (2019). An improved question format for measuring conspiracy beliefs. *Public Opinion Quarterly*, *83*(4), 690–722. https://doi.org/10.1093/poq/nfz049

Clifford, S., & Sullivan, B. W. (2023). Do Survey Questions Spread Conspiracy Beliefs? *Journal of Experimental Political Science*, *10*(2), 231–241. Cambridge Core. https://doi.org/10.1017/XPS.2023.1

Coan, T. G., Boussalis, C., Cook, J., & Nanko, M. O. (2021). Computer-assisted classification of contrarian claims about climate change. *Scientific Reports*, *11*(1), 22320. https://doi.org/10.1038/s41598-021-01714-4

Cook, J., Lewandowsky, S., & Ecker, U. K. H. (2017). Neutralizing misinformation through inoculation: Exposing misleading argumentation techniques reduces their influence. *PLOS ONE*, *12*(5), e0175799. https://doi.org/10.1371/journal.pone.0175799

De Ayala, R. J. (2022). *The theory and practice of item response theory* (Second edition). The Guilford Press.

De Graaf, J. A., Stok, F. M., De Wit, J. B. F., & Bal, M. (2023). The climate change skepticism questionnaire: Validation of a measure to assess doubts regarding climate change. *Journal of Environmental Psychology*, *89*, 102068. https://doi.org/10.1016/j.jenvp.2023.102068

De Groot, J. I. M., & Steg, L. (2007). Value Orientations and Environmental Beliefs in Five Countries: Validity of an Instrument to Measure Egoistic, Altruistic and Biospheric Value Orientations. *Journal of Cross-Cultural Psychology*, *38*(3), 318–332. https://doi.org/10.1177/0022022107300278

Diamond, E., Bernauer, T., & Mayer, F. (2020). Does providing scientific information affect climate change and GMO policy preferences of the mass public? Insights from survey experiments in Germany and the United States. *Environmental Politics*, *29*(7), 1199–1218. https://doi.org/10.1080/09644016.2020.1740547

Diehl, T., Huber, B., Gil De Zúñiga, H., & Liu, J. (2021). Social media and beliefs about climate change: A cross-national analysis of news use, political ideology, and trust in science. *International Journal of Public Opinion Research*, *33*(2), 197–213. https://doi.org/10.1093/ijpor/edz040

Ding, D., Maibach, E. W., Zhao, X., Roser-Renouf, C., & Leiserowitz, A. (2011). Support for climate policy and societal action are linked to perceptions about scientific agreement. *Nature Climate Change*, *1*(9), 462–466. https://doi.org/10.1038/nclimate1295

Dorie, V., Chipman, H., & McCulloch, R. (2026). *dbarts: Discrete Bayesian Additive Regression Trees sampler* (p. 0.9-33) [Computer software]. https://doi.org/10.32614/CRAN.package.dbarts

Douglas, M., & Wildavsky, A. (1982). *Risk and culture: An essay on the selection of technological and environmental dangers* (1st ed.). University of California Press. JSTOR. http://www.jstor.org/stable/10.1525/j.ctt7zw3mr

Drews, S., & Van Den Bergh, J. C. J. M. (2016). What explains public support for climate policies? A review of empirical and experimental studies. *Climate Policy*, *16*(7), 855–876. https://doi.org/10.1080/14693062.2015.1058240

Dunlap, R. E., Van Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). New trends in measuring environmental attitudes: Measuring endorsement of the New Ecological Paradigm: A revised NEP scale. *Journal of Social Issues*, *56*(3), 425–442. https://doi.org/10.1111/0022-4537.00176

Eckardt, J., Turgeon, M., Pereira Filho, A., & Lachapelle, E. (under review). *Measuring climate change misinformation* [Unpublished manuscript].

Ecklund, E. H., Scheitle, C. P., Peifer, J., & Bolger, D. (2017). Examining links between religion, evolution views, and climate change skepticism. *Environment and Behavior*, *49*(9), 985–1006. https://doi.org/10.1177/0013916516674246

Ejaz, W., Altay, S., Fletcher, R., & Nielsen, R. K. (2024). Trust is key: Determinants of false beliefs about climate change in eight countries. *New Media & Society*, 14614448241250302. https://doi.org/10.1177/14614448241250302

European Agency For Safety And Health At Work. (2023). *OSH Pulse—Occupational Safety and Health in Post-Pandemic Workplaces (Flash Eurobarometer)* (Version 2.0.0) [Data set]. GESIS. https://doi.org/10.4232/1.14208

Freminot, K., Major-Smith, K., Northstone, K., Halstead, I., & Major-Smith, D. (2024). Associations between Big-5 personality traits, cognitive ability, and climate beliefs and behaviours: Results from a longitudinal UK birth cohort. *Europe's Journal of Psychology*, *20*(4), 288–302. https://doi.org/10.5964/ejop.13657

Geiger, S. J., Imada, H., Maharja, C., Powdthavee, N., Vitale, V., Zhang, L., Rosa, C. D., Delabrida, Z. N. C., Nielsen, K. S., Essl, F., & White, M. P. (2025). Understanding the role of pluralistic ignorance in biodiversity conservation: A research agenda. *Global Environmental Change*, *95*, 103043. https://doi.org/10.1016/j.gloenvcha.2025.103043

Gosling, S. D., Rentfrow, P. J., & Swann, W. B. (2003). A very brief measure of the Big-Five personality domains. *Journal of Research in Personality*, *37*(6), 504–528. https://doi.org/10.1016/S0092-6566(03)00046-1

Graham, M. H. (2020). Self-Awareness of Political Knowledge. *Political Behavior*, *42*(1), 305–326. https://doi.org/10.1007/s11109-018-9499-8

Graham, M. H. (2023). Measuring misperceptions? *American Political Science Review*, *117*(1), 80–102. https://doi.org/10.1017/S0003055422000387

Grant, W. J. (2023). The knowledge deficit model and science communication. In W. J. Grant, *Oxford Research Encyclopedia of Communication*. Oxford University Press. https://doi.org/10.1093/acrefore/9780190228613.013.1396

Grapsas, S., Becht, A. I., & Thomaes, S. (2023). Self-focused value profiles relate to climate change skepticism in young adolescents. *Journal of Environmental Psychology*, *87*, 101978. https://doi.org/10.1016/j.jenvp.2023.101978

Grün, B., & Malsiner-Walli, G. (2022). Bayesian Finite Mixture Models. In R. S. Kenett, N. T. Longford, W. W. Piegorsch, & F. Ruggeri (Eds.), *Wiley StatsRef: Statistics Reference Online* (1st ed., pp. 1–19). Wiley. https://doi.org/10.1002/9781118445112.stat08373

Guo, T., & Spina, R. (2019). Cross-Cultural Variations in Extreme Rejecting and Extreme Affirming Response Styles. *Journal of Cross-Cultural Psychology*, *50*(8), 955–971. https://doi.org/10.1177/0022022119873072

Guy, S., Kashima, Y., Walker, I., & O'Neill, S. (2014). Investigating the effects of knowledge and ideology on climate change beliefs. *European Journal of Social Psychology*, *44*(5), 421–429. https://doi.org/10.1002/ejsp.2039

Haden, V. R., Niles, M. T., Lubell, M., Perlman, J., & Jackson, L. E. (2012). Global and Local Concerns: What Attitudes and Beliefs Motivate Farmers to Mitigate and Adapt to Climate Change? *PLoS ONE*, *7*(12), e52882. https://doi.org/10.1371/journal.pone.0052882

Häkkinen, K., & Akrami, N. (2014). Ideology and climate change denial. *Personality and Individual Differences*, *70*, 62–65. https://doi.org/10.1016/j.paid.2014.06.030

Haltinner, K., & Sarathchandra, D. (2018). Climate change skepticism as a psychological coping strategy. *Sociology Compass*, *12*(6), e12586. https://doi.org/10.1111/soc4.12586

Haltinner, K., & Sarathchandra, D. (2021). Considering attitudinal uncertainty in the climate change skepticism continuum. *Global Environmental Change*, *68*, 102243. https://doi.org/10.1016/j.gloenvcha.2021.102243

Harzing, A.-W. (2006). Response Styles in Cross-national Survey Research: A 26-country Study. *International Journal of Cross Cultural Management*, *6*(2), 243–266. https://doi.org/10.1177/1470595806066332

Heath, Y., & Gifford, R. (2006). Free-market ideology and environmental degradation: The case of belief in global climate change. *Environment and Behavior*, *38*(1), 48–71. https://doi.org/10.1177/0013916505277998

Hilbig, B. E. (2024). Judgments and beliefs about climate change: Measurement, stability, and behavioral consequences. *Judgment and Decision Making*, *19*, e32. https://doi.org/10.1017/jdm.2024.33

Hill, S. J., & Roberts, M. E. (2023). Acquiescence bias inflates estimates of conspiratorial beliefs and political misperceptions. *Political Analysis*, *31*(4), 575–590. https://doi.org/10.1017/pan.2022.28

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

Hornsey, M. J., Harris, E. A., & Fielding, K. S. (2018). Relationships among conspiratorial beliefs, conservatism and climate scepticism across nations. *Nature Climate Change*, *8*(7), 614–620. https://doi.org/10.1038/s41558-018-0157-2

Hornsey, M. J., & Lewandowsky, S. (2022). A toolkit for understanding and addressing climate scepticism. *Nature Human Behaviour*, *6*(11), 1454–1464. https://doi.org/10.1038/s41562-022-01463-y

Howe, P. D. (2021). Extreme weather experience and climate change opinion. *Current Opinion in Behavioral Sciences*, *42*, 127–131. https://doi.org/10.1016/j.cobeha.2021.05.005

Hurst Loo, A. M., & Walker, B. R. (2023). Climate change knowledge influences attitude to mitigation via efficacy beliefs. *Risk Analysis*, *43*(6), 1162–1173. https://doi.org/10.1111/risa.14026

Incerti, T., & Lipscy, P. Y. (2018). The politics of energy and climate change in Japan under Abe. *Asian Survey*, *58*(4), 607–634. JSTOR.

Jacques, P. J., & Knox, C. C. (2016). Hurricanes and hegemony: A qualitative analysis of micro-level climate change denial discourses. *Environmental Politics*, *25*(5), 831–852. https://doi.org/10.1080/09644016.2016.1189233

Johnson, B. B., & Swedlow, B. (2024). Scale reliability of alternative cultural theory survey measures. *Quality & Quantity*, *58*(1), 527–557. https://doi.org/10.1007/s11135-023-01653-4

Kahan, D. M. (2013). Ideology, motivated reasoning, and cognitive reflection. *Judgment and Decision Making*, *8*(4), 407–424. https://doi.org/10.1017/S1930297500005271

Kahan, D. M., Braman, D., Gastil, J., Slovic, P., & Mertz, C. K. (2007). Culture and Identity-Protective Cognition: Explaining the White-Male Effect in Risk Perception. *Journal of Empirical Legal Studies*, *4*(3), 465–505. https://doi.org/10.1111/j.1740-1461.2007.00097.x

Kahan, D. M., Jenkins-Smith, H., Tarantola, T., Silva, C. L., & Braman, D. (2015). Geoengineering and climate change polarization: Testing a two-channel model of science communication. *The ANNALS of the American Academy of Political and Social Science*, *658*(1), 192–222. https://doi.org/10.1177/0002716214559002

Kay, C. S., & Slovic, P. (2023). The generic conspiracist beliefs scale – 5: A short-form measure of conspiracist ideation. *Journal of Research in Personality*, *102*, 104315. https://doi.org/10.1016/j.jrp.2022.104315

Kiral Ucar, G., Gezici Yalcin, M., Özdemir Planalı, G., & Reese, G. (2023). Social identities, climate change denial, and efficacy beliefs as predictors of pro-environmental engagements. *Journal of Environmental Psychology*, *91*, 102144. https://doi.org/10.1016/j.jenvp.2023.102144

Kolenatý, M., Kroufek, R., & Činčera, J. (2022). What triggers climate action: The impact of a climate change education program on students' climate literacy and their willingness to act. *Sustainability*, *14*(16), 10365. https://doi.org/10.3390/su141610365

Kosugi, M., & Baba, K. (2023). Five types on perception of global warming in Japanese. *Frontiers in Climate*, *5*, 1227585. https://doi.org/10.3389/fclim.2023.1227585

Kuklinski, J. H., Quirk, P. J., Jerit, J., Schwieder, D., & Rich, R. F. (2000). Misinformation and the currency of democratic citizenship. *The Journal of Politics*, *62*(3), 790–816. JSTOR.

Kunda, Z. (1999). *Social cognition: Making sense of people*. The MIT Press. https://doi.org/10.7551/mitpress/6291.001.0001

Kyselá, E., Ščasný, M., & Zvěřinová, I. (2019). Attitudes toward climate change mitigation policies: A review of measures and a construct of policy attitudes. *Climate Policy*, *19*(7), 878–892. https://doi.org/10.1080/14693062.2019.1611534

Lachapelle, E., Borick, C. P., & Rabe, B. (2012). Public Attitudes toward Climate Science and Climate Policy in Federal Systems: Canada and the United States Compared. *Review of Policy Research*, *29*(3), 334–357. https://doi.org/10.1111/j.1541-1338.2012.00563.x

Lee, T. M., Markowitz, E. M., Howe, P. D., Ko, C.-Y., & Leiserowitz, A. A. (2015). Predictors of public climate change awareness and risk perception around the world. *Nature Climate Change*, *5*(11), 1014–1020. https://doi.org/10.1038/nclimate2728

Leiserowitz, A., Roser-Renouf, C., Marlon, J., & Maibach, E. (2021). Global Warming's Six Americas: A review and recommendations for climate change communication. *Current Opinion in Behavioral Sciences*, *42*, 97–103. https://doi.org/10.1016/j.cobeha.2021.04.007

Leka, J., & Furnham, A. (2024). Correlates of climate change skepticism. *Frontiers in Psychology*, *15*, 1328307. https://doi.org/10.3389/fpsyg.2024.1328307

Lewandowsky, S., Gignac, G. E., & Oberauer, K. (2013). The role of conspiracist ideation and worldviews in predicting rejection of science. *PLoS ONE*, *8*(10), e75637. https://doi.org/10.1371/journal.pone.0075637

Linzer, D. A., & Lewis, J. B. (2011). **poLCA**: An *R* package for polytomous variable latent class analysis. *Journal of Statistical Software*, *42*(10). https://doi.org/10.18637/jss.v042.i10

Luo, C., & Daniels, M. J. (2024). Variable selection using Bayesian Additive Regression Trees. *Statistical Science*, *39*(2). https://doi.org/10.1214/23-STS900

Malsiner-Walli, G., Frühwirth-Schnatter, S., & Grün, B. (2016). Model-based clustering based on sparse finite Gaussian mixtures. *Statistics and Computing*, *26*(1–2), 303–324. https://doi.org/10.1007/s11222-014-9500-2

Mateer, T. J., Melton, T. N., Miller, Z. D., Lawhon, B., Agans, J. P., & Taff, B. D. (2022). A multi-dimensional measure of pro-environmental behavior for use across populations with varying levels of environmental involvement in the United States. *PLOS ONE*, *17*(10), e0274083. https://doi.org/10.1371/journal.pone.0274083

McCright, A. M., & Dunlap, R. E. (2011). Cool dudes: The denial of climate change among conservative white males in the United States. *Global Environmental Change*, *21*(4), 1163–1172. https://doi.org/10.1016/j.gloenvcha.2011.06.003

McCright, A. M., Dunlap, R. E., & Marquart-Pyatt, S. T. (2016). Political ideology and views about climate change in the European Union. *Environmental Politics*, *25*(2), 338–358. https://doi.org/10.1080/09644016.2015.1090371

Morrison, M., Duncan, R., & Parton, K. (2015). Religion does matter for climate change attitudes and behavior. *PLOS ONE*, *10*(8), e0134868. https://doi.org/10.1371/journal.pone.0134868

Motta, M., Chapman, D., Stecula, D., & Haglin, K. (2019). An experimental examination of measurement disparities in public climate change beliefs. *Climatic Change*, *154*(1–2), 37–47. https://doi.org/10.1007/s10584-019-02406-9

Moxnes, E., & Saysel, A. K. (2009). Misperceptions of global climate change: Information policies. *Climatic Change*, *93*(1–2), 15–37. https://doi.org/10.1007/s10584-008-9465-2

Nartova-Bochaver, S. K., Donat, M., Kiral Ucar, G., Korneev, A. A., Heidmets, M. E., Kamble, S., Khachatryan, N., Kryazh, I. V., Larionow, P., Rodríguez-González, D., Serobyan, A., Zhou, C., & Clayton, S. (2022). The role of environmental identity and individualism/collectivism in predicting climate change denial: Evidence from nine countries. *Journal of Environmental Psychology*, *84*, 101899. https://doi.org/10.1016/j.jenvp.2022.101899

Nicolosi, E., Medina, R., Brewer, S., Vorkink, M., & Allred, A. (2025). The new denial: Climate *solution* misinformation on social media. *Global Sustainability*, *8*, e31. https://doi.org/10.1017/sus.2025.10016

Nielsen, K. S., Nicholas, K. A., Creutzig, F., Dietz, T., & Stern, P. C. (2021). The role of high-socioeconomic-status people in locking in or rapidly reducing energy-driven greenhouse gas emissions. *Nature Energy*, *6*(11), 1011–1016. https://doi.org/10.1038/s41560-021-00900-y

Oreskes, N., & Conway, E. M. (2011). *Merchants of Doubt: How a handful of scientists obscured the truth on issues from Tobacco Smoke to Global Warming*. Bloomsbury Publishing Plc.

Painter, J., Ettinger, J., Holmes, D., Loy, L., Pinto, J., Richardson, L., Thomas-Walters, L., Vowles, K., & Wetts, R. (2023). Climate delay discourses present in global mainstream television coverage of the IPCC's 2021 report. *Communications Earth & Environment*, *4*(1), 118. https://doi.org/10.1038/s43247-023-00760-2

Pan, W.-L., Fan, R., Pan, W., Ma, X., Hu, C., Fu, P., & Su, J. (2023). The role of climate literacy in individual response to climate change: Evidence from China. *Journal of Cleaner Production*, *405*, 136874. https://doi.org/10.1016/j.jclepro.2023.136874

Pasek, J., Sood, G., & Krosnick, J. A. (2015). Misinformed about the affordable care act? Leveraging certainty to assess the prevalence of misperceptions. *Journal of Communication*, *65*(4), 660–673. https://doi.org/10.1111/jcom.12165

Pennycook, G. (2023). A framework for understanding reasoning errors: From fake news to climate change and beyond. In *Advances in Experimental Social Psychology* (Vol. 67, pp. 131–208). Elsevier. https://doi.org/10.1016/bs.aesp.2022.11.003

Poortinga, W., Spence, A., Whitmarsh, L., Capstick, S., & Pidgeon, N. F. (2011). Uncertain climate: An investigation into public scepticism about anthropogenic climate change. *Global Environmental Change*, *21*(3), 1015–1024. https://doi.org/10.1016/j.gloenvcha.2011.03.001

Pratto, F., Çidam, A., Stewart, A. L., Zeineddine, F. B., Aranda, M., Aiello, A., Chryssochoou, X., Cichocka, A., Cohrs, J. C., Durrheim, K., Eicher, V., Foels, R., Górska, P., Lee, I.-C., Licata, L., Liu, J. H., Li, L., Meyer, I., Morselli, D., … Henkel, K. E. (2013). Social Dominance in Context and in Individuals: Contextual Moderation of Robust Effects of Social Dominance Orientation in 15 Languages and 20 Countries. *Social Psychological and Personality Science*, *4*(5), 587–599. https://doi.org/10.1177/1948550612473663

Pröpper, H. Y. L., Geiger, S., Blanken, T. F., & Brick, C. (2022). Truth over identity? Cultural cognition weakly replicates across 23 countries. *Journal of Environmental Psychology*, *83*, 101865. https://doi.org/10.1016/j.jenvp.2022.101865

Sarathchandra, D., & Haltinner, K. (2023). How media, information sources, and trust shape climate change denial or doubt. *Social Currents*, *10*(6), 583–602. https://doi.org/10.1177/23294965231168785

Shi, J., Visschers, V. H. M., Siegrist, M., & Arvai, J. (2016). Knowledge as a driver of public perceptions about climate change reassessed. *Nature Climate Change*, *6*(8), 759–762. https://doi.org/10.1038/nclimate2997

Sibley, C. G., & Kurz, T. (2013). A model of climate belief profiles: How much does it matter If people question human causation? *Analyses of Social Issues and Public Policy*, *13*(1), 245–261. https://doi.org/10.1111/asap.12008

Spampatti, T., Hahnel, U. J. J., Trutnevyte, E., & Brosch, T. (2023). Psychological inoculation strategies to fight climate disinformation across 12 countries. *Nature Human Behaviour*, *8*(2), 380–398. https://doi.org/10.1038/s41562-023-01736-0

Steg, L. (2018). Limiting climate change requires research on climate action. *Nature Climate Change*, *8*(9), 759–761. https://doi.org/10.1038/s41558-018-0269-8

Stoetzer, L. S., & Zimmermann, F. (2024). A representative survey experiment of motivated climate change denial. *Nature Climate Change*, *14*(2), 198–204. https://doi.org/10.1038/s41558-023-01910-2

Stoutenborough, J. W., & Vedlitz, A. (2014). The effect of perceived and assessed knowledge of climate change on public policy concerns: An empirical comparison. *Environmental Science & Policy*, *37*, 23–33. https://doi.org/10.1016/j.envsci.2013.08.002

Swedlow, B., Ripberger, J. T., Liu, L., Silva, C. L., Jenkins-Smith, H., & Johnson, B. B. (2020). Construct validity of Cultural Theory survey measures. *Social Science Quarterly*, *101*(6), 2332–2383. https://doi.org/10.1111/ssqu.12859

Takagi, A., & Takeda, M. (2025). *Cultural Worldviews and Public Risk Perception Regarding Climate Change in Japan* (No. 1). The Society for Risk Analysis, Japan. https://doi.org/10.11447/jjra.O-24-021

Tobler, C., Visschers, V. H. M., & Siegrist, M. (2012). Consumers' knowledge about climate change. *Climatic Change*, *114*(2), 189–209. https://doi.org/10.1007/s10584-011-0393-1

Treen, K. M. d'I., Williams, H. T. P., & O'Neill, S. J. (2020). Online misinformation about climate change. *WIREs Climate Change*, *11*(5), e665. https://doi.org/10.1002/wcc.665

Tucholska, K., Gulla, B., & Ziernicka-Wojtaszek, A. (2024). Climate change beliefs, emotions and pro-environmental behaviors among adults: The role of core personality traits and the time perspective. *PLOS ONE*, *19*(4), e0300246. https://doi.org/10.1371/journal.pone.0300246

Tvinnereim, E., & Ivarsflaten, E. (2016). Fossil fuels, employment, and support for climate policies. *Energy Policy*, *96*, 364–371. https://doi.org/10.1016/j.enpol.2016.05.052

Uscinski, J., Enders, A., Diekman, A., Funchion, J., Klofstad, C., Kuebler, S., Murthi, M., Premaratne, K., Seelig, M., Verdear, D., & Wuchty, S. (2022). The psychological and political correlates of conspiracy theory beliefs. *Scientific Reports*, *12*(1), 21672. https://doi.org/10.1038/s41598-022-25617-0

Vainio, A., & Paloniemi, R. (2013). Does belief matter in climate change action? *Public Understanding of Science*, *22*(4), 382–395. https://doi.org/10.1177/0963662511410268

Van Der Linden, S. (2015). The social-psychological determinants of climate change risk perceptions: Towards a comprehensive model. *Journal of Environmental Psychology*, *41*, 112–124. https://doi.org/10.1016/j.jenvp.2014.11.012

Van Der Linden, S. (2017). Determinants and Measurement of Climate Change Risk Perception, Worry, and Concern. In S. Van Der Linden, *Oxford Research Encyclopedia of Climate Science*. Oxford University Press. https://doi.org/10.1093/acrefore/9780190228620.013.318

Van Valkengoed, A. M., Perlaviciute, G., & Steg, L. (2024). From believing in climate change to adapting to climate change: The role of risk perception and efficacy beliefs. *Risk Analysis*, *44*(3), 553–565. https://doi.org/10.1111/risa.14193

Van Valkengoed, A. M., & Steg, L. (2019). Meta-analyses of factors motivating climate change adaptation behaviour. *Nature Climate Change*, *9*(2), 158–163. https://doi.org/10.1038/s41558-018-0371-y

Van Valkengoed, A. M., Steg, L., & Perlaviciute, G. (2021). Development and validation of a climate change perceptions scale. *Journal of Environmental Psychology*, *76*, 101652. https://doi.org/10.1016/j.jenvp.2021.101652

Van Zomeren, M., Saguy, T., & Schellhaas, F. M. H. (2013). Believing in "making a difference" to collective efforts: Participative efficacy beliefs as a unique predictor of collective action. *Group Processes & Intergroup Relations*, *16*(5), 618–634. https://doi.org/10.1177/1368430212467476

Vázquez, A., Larzabal-Fernández, A., & Lois, D. (2021). Situational materialism increases climate change scepticism in men compared to women. *Journal of Experimental Social Psychology*, *96*, 104163. https://doi.org/10.1016/j.jesp.2021.104163

Većkalov, B., Geiger, S. J., Bartoš, F., White, M. P., Rutjens, B. T., Van Harreveld, F., Stablum, F., Akın, B., Aldoh, A., Bai, J., Berglund, F., Bratina Zimic, A., Broyles, M., Catania, A., Chen, A., Chorzępa, M., Farahat, E., Götz, J., Hoter-Ishay, B., … Van Der Linden, S. (2024). A 27-country test of communicating the scientific consensus on climate change. *Nature Human Behaviour*, *8*(10), 1892–1905. https://doi.org/10.1038/s41562-024-01928-2

Vermunt, J. K. (2010). Latent Class Modeling with Covariates: Two Improved Three-Step Approaches. *Political Analysis*, *18*(4), 450–469. Cambridge Core. https://doi.org/10.1093/pan/mpq025

Vraga, E. K., & Bode, L. (2020). Defining misinformation and understanding its bounded nature: Using expertise and evidence for describing misinformation. *Political Communication*, *37*(1), 136–144. https://doi.org/10.1080/10584609.2020.1716500

Weller, B. E., Bowen, N. K., & Faubert, S. J. (2020). Latent Class Analysis: A guide to best practice. *Journal of Black Psychology*, *46*(4), 287–311. https://doi.org/10.1177/0095798420930932

Westwood, S. J. (2025). The potential existential threat of large language models to online survey research. *Proceedings of the National Academy of Sciences*, *122*(47), e2518075122. https://doi.org/10.1073/pnas.2518075122

Whitmarsh, L. (2008). Are flood victims more concerned about climate change than other people? The role of direct experience in risk perception and behavioural response. *Journal of Risk Research*, *11*(3), 351–374. https://doi.org/10.1080/13669870701552235

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

Zawadzki, S. J., Bouman, T., Steg, L., Bojarskich, V., & Druen, P. B. (2020). Translating climate beliefs into action in a changing political landscape. *Climatic Change*, *161*(1), 21–42. https://doi.org/10.1007/s10584-020-02739-w

Ziegler, A. (2017). Political orientation, environmental values, and climate change beliefs and attitudes: An empirical cross country analysis. *Energy Economics*, *63*, 144–153. https://doi.org/10.1016/j.eneco.2017.01.022

Section A – Exclusion Criteria

A priori exclusions

As noted in the Data section of the main text, several exclusion criteria were implemented during data collection to ensure high data quality. First, since the main climate information battery requires respondents to evaluate a series of claims regarding the factual accuracy of a variety of claims, use of external sources would compromise the quality of the data. To reduce this a "commitment item," proposed by Clifford and Jerit (2016) to reduce respondent cheating on political knowledge questions, was included. The item asks respondents to refrain from consulting external sources when completing the survey. Respondents who did not agree to complete the survey without using outside sources were excluded from the final sample. The item was worded as follows:

Now we have a set of questions concerning climate change. Climate change refers to a long-term change in the average weather patterns in the Earth's regions. We want to see how much information about it gets out to the public from television, newspapers, and the like. It is important to us that you do NOT use outside sources like the Internet to search for the correct answer. Will you answer the following questions without help from outside sources?

a. Yes (1)

b. No (2)

Second, an attention check was embedded in the 13th position of the climate information battery. The item instructed respondents to select a specific response and was used to identify inattentive responding. The item read:

This is a simple question. You don't need to be a wine connoisseur or avid beer drinker to answer. When asked for your favorite drink, you need to select carrot juice.
Based on the text above, what is your favorite drink?

Wine (1)
Beer (2)
Vodka (3)
Whiskey (4)
Carrot juice (5)
Other (6)

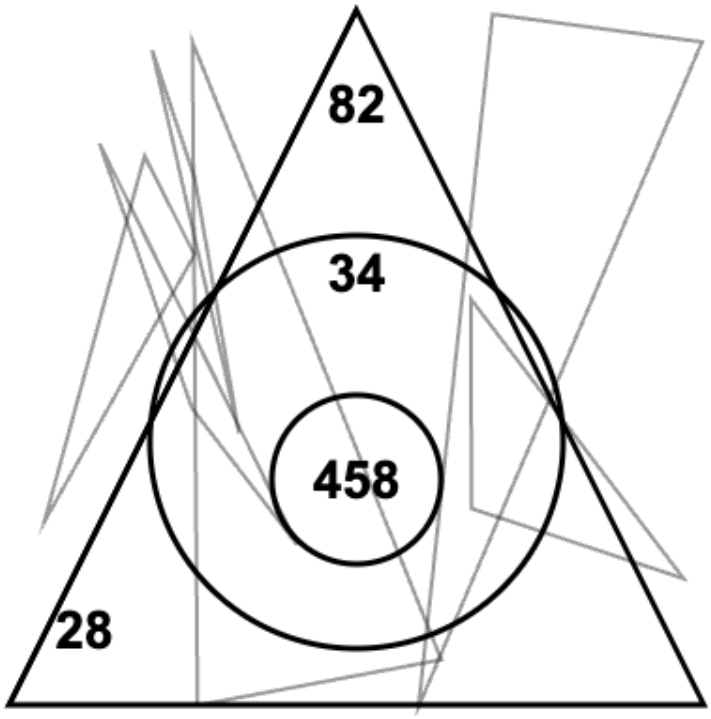
Respondents who selected any option other than "carrot juice" were excluded from the analysis.

Post-hoc exclusions

Beyond these two a priori screening items, several additional post hoc exclusion criteria were applied to further address data quality concerns. In light of recent discussions regarding automated and bot-like response patterns in online survey research (Westwood, 2025), two procedures were implemented to mitigate potential non-human responses. First, respondents with a Google reCAPTCHA score below 0.5, which is the tool's default threshold for flagging respondents as potential bots, were excluded.

Second, an optical recognition task was included in which respondents were asked to identify and enter a number embedded within a visual array of shapes designed override the optical recognition capabilities of more advanced LLMs. These images were randomly generated and pre-tested using a large language model (GPT-5.3). Only images that the model failed to correctly identify were retained, which resulted in a final set of seven images. Each respondent was then randomly assigned to one of these seven variants, which varied in layout and numeric content. An example of the task is provided below:

Before proceeding to the main part of the survey, we want to confirm that you are human. Please enter the three-digit number shown in the smallest (innermost) circle below.



While this procedure may not identify all automated agents, it resulted in the exclusion of a substantial number of respondents across all three countries, particularly in Japan.

Respondents with unusually short completion times (less than one third of the country-specific median survey duration) were also excluded. Finally, a small number of duplicate responses were removed to ensure that no respondent who was exposed to the study debriefing containing the correct answers to the climate information battery answered the survey again with this knowledge.

Section B – Measures

Main questionnaire and item validation

This subsection provides the questions used in the main climate information battery as well as the IPCC reports or other sources used to validate them. The battery is identical to a previously developed instrument by the author of this study and coauthors Turgeon, Pereira Filho, and Lachapelle (under review), with the exception of Items 8 and 13, which were revised for the present study. The full set of items is provided below. The order of these items was randomized for each respondent.

Item	Context	Correct claim	Incorrect claim
1	Ice sheets	Polar ice sheets are melting	Polar ice sheets are not melting
2	Extreme weather events	Extreme weather events are increasing globally	Extreme weather events are not increasing globally
3	Global temperature increasing	Global temperatures have been warming over the last century	Global temperatures have not been warming over the last century
4	Sea level rise	Sea levels are rising	Sea levels are not rising
5	Anthropogenic climate change	Climate change observed over the last century is mostly caused by human activity	Climate change observed over the last century is mostly part of a natural cycle
6	Influence of CO2	Carbon dioxide (CO2) contributes to climate change	Carbon dioxide (CO2) does not contribute to climate change
7	Meat consumption	Meat consumption contributes to climate change	Meat consumption does not contribute to climate change
8	Aerosol cooling	The cooling effect of aerosols produced by human activity is much smaller than the warming effect of human CO2 emissions	The cooling effect of aerosols produced by human activity largely cancels out the warming effect of human CO2 emissions
9	Wildfires	Climate change contributes to more frequent wildfires	Climate change does not contribute to more frequent wildfires
10	Insects & disease transmission	Climate change increases diseases spread by insects such as fleas, ticks, and mosquitoes	Climate change does not increase diseases spread by insects such as fleas, ticks, and mosquitoes
11	Supply chains	Climate change disrupts supply chains, increasing grocery bills	Climate change does not disrupt supply chains, leaving grocery bills unaffected
12	Polar bear populations	Polar bear populations are decreasing as a result of climate change	Polar bear populations are not decreasing as a result of climate change
13	Electric vehicles	Electric vehicles have lower lifecycle CO2 emissions than gasoline and diesel vehicles	Electric vehicles have higher lifecycle CO2 emissions
14	Renewables emissions	Renewable power plants emit less CO2 over their lifetime than coal and gas plants	Renewable power plants emit more CO2 over their lifetime than coal and gas plants
15	Renewables public opinion	The majority of Canadians/Americans support prioritizing solar and wind over fossil fuels	The majority of Canadians/Americans support prioritizing fossil fuels over solar and wind
16	Oil and gas operations & net zero	Canada/the U.S. cannot continue expanding oil and gas production at current rates and reach its net zero targets/reach net zero emissions	Canada/the U.S. can continue expanding oil and gas production at current rates and reach its net zero targets/reach net zero
17	Scientific consensus	Nearly all climate scientists (>95%) agree that climate change is caused by humans	Only a slight majority (~50%) agree
18	False balance	Environmental groups have weaker influence on politics than the fossil fuel industry	Environmental groups have greater influence than the fossil fuel industry

Item	Context	Correct claim	Incorrect claim
19	Environmental groups	The media underrepresents scientists who believe climate change is real relative to their actual share among experts	The media overrepresents them
20	Climate science data	Climate science relies on data from the real world	Climate science relies on fake data

Table B1: List of items and corresponding correct and incorrect claims used in climate information battery.

Question Number	**Question Subject**	**IPCC Report Short Title**	**Chapter/Page Number**	**Author/Year**	**Confidence**
1	Ice sheets	IPCC Special Report on Ocean and Cryosphere in a Changing Climate (SROCC)	TS (p.43)	IPCC (2019)	High
2	Extreme weather events	IPCC Sixth Assessment Report (WG 1)	TS (p. 59)	Arias et al. (2021)	High*
3	Global temperature increasing	Global Warming of 1.5°C	1 (p. 51)	Allen et al. (2018)	High†
4	Sea level rise	IPCC Special Report on Ocean and Cryosphere in a Changing Climate (SROCC)	TS (p. 52)	IPCC (2019)	Very high
5	Anthropogenic climate change	IPCC Sixth Assessment Report (WG1)	SPM (p. 4)	IPCC (2021)	Unequivocal
6	Influence of CO2	AR5 Climate Change 2014 Synthesis Report	SPM	IPCC (2014)	Established fact‡
7	Meat consumption	IPCC Sixth Assessment Report (WG 3)	TS (p. 111)	Pathak et al. (2022)	High
8	Aerosol cooling	IPCC Sixth Assessment Report (WG 1)	7 (p. 948)	Forster et al. (2022)	Medium confidence (specific magnitude estimates); unequivocal that aerosols do not offset greenhouse gas forcing.
9	Wildfires	IPCC Sixth Assessment Report (WG 2)	14 (p. 1931)	Hicke et al. (2022)	Medium

10	Insects & disease transmission	AR6 Climate Change 2023 Synthesis Report	SPM (p. 6)	IPCC (2023)	High
11	Supply chains	IPCC Sixth Assessment Report (WG 2)	SPM (pp. 18 – 19)	IPCC (2022)	High
12	Polar bear populations	IPCC Fifth Assessment Report (WG 2)	28 (p. 1588)	Larsen et al. (2014)	Very high
13	Electric vehicles	IPCC Sixth Assessment Report (WG 3)	10 (p. 1052)	Jaramillo et al. (2022)	High§
14	Renewables emissions	IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation	9 (p. 732)	Sathaye et al. (2011)	High – very high¶
15	Renewables public opinion	IPCC Sixth Assessment Report (WG 3)	6 (pp. 633, 637, 648)	Clark et al. (2022) **Canada:** Hatch et al. (2024) **U.S.:** Tyson et al. (2023)	High
16	Oil and gas operations & net zero	Special Report: Global Warming of 1.5 °C	2 (p.96)	Rogelj et al. (2018)	High
17	Scientific consensus	/	/	Lynas et al. (2021)	NA
18	False balance	/	/	Petersen et al. (2019)	NA
19	Environmental groups	/	/	**Canada:** Logan & Richer Vis (2023)[19] **U.S.:** OpenSecrets (2024) & OpenSecrets (2024)	NA
20	Climate science data	/	/	NASA (2024)	NA

Table B2: Sources used to validate veracity of claims used in the climate information battery.

Note: *Confidence for increases in extreme weather events may vary by region (see Table TS.5 in the corresponding report). The report notes that on a global scale, however, 'climate change has already altered CID [Climate-impact drivers] profiles and resulted in shifting magnitude, frequency, duration, seasonality and spatial extent of associated indices' (p. 59) and issues high confidence for this assertion;

†The source refers to confidence in the specific extent of the human contribution to observed increases, which inherently includes confidence that an increase has occurred in the first place;

‡Repeatedly referred to as a key driver of observed climate changes. While no explicit level of confidence is assigned, the cited report discusses in detail how carbon dioxide and other greenhouse gases contribute to climate change.;

§ The IPCC's finding applies under low-carbon electricity conditions. In all three cases studied (Canada, the United States, and Japan), electricity systems are sufficiently low-carbon for BEVs to generally achieve lower lifecycle emissions than combustion engines.

¶While IPCC authors did not assign standardized confidence levels in reports published prior to the Fifth Assessment Report released in 2014, Figure 9.8 in the cited report presents a meta-analysis of lifecycle emissions whose results can reasonably be interpreted as reflecting at least high confidence.

Measurement of outcomes and predictors of climate information

Below, Table B3 provides an overview of the items used to create the indices representing climate concern, policy support, efficacy and behavior. On the following page, Table B4 presents the survey items used to construct the predictors included in the exploratory analyses of the determinants of climate information, along with information on their coding. For ease of reference, variables are grouped according to the categories used in Figures 4–6 of the main text (SES, Values, Trust, Climate, and Lifestyle).

Outcome	*Survey item(s)*	*Scale and coding*
Climate concern	(1) How worried are you about impacts of climate change for people around the world?; (2) How worried are you about impacts of climate change on your personal life?	5-point scale (1 = not at all worried, 5 = very worried); mean of 2 items
Policy support	Please indicate how strongly you support or oppose each of the following policies: (1) Increase government funding for renewable energy like hydro, wind, and solar; (2) Increase government funding for nuclear energy*; (3) Apply a carbon tax on fossil fuels like coal, oil, gasoline, and natural gas; (4) Apply tariffs on countries with weaker climate policies; (5) Limit total oil and gas production each year to meet climate targets; (6) Ban the sale of new gasoline-powered vehicles after 2035; (7) Educate citizens about climate change and actions to reduce carbon emissions.	5-point scale (1 = strongly oppose, 5 = strongly support); mean of 6 items (7 items for Canada and U.S.)
Efficacy	(1) Actions I take personally can meaningfully help tackle climate change; (2) If people work together, humans can meaningfully reduce climate change; (3) Government policies can have a significant impact on limiting climate change.	5-point agree–disagree (1 = strongly disagree, 5 = strongly agree); mean of 3 items
Behavior	Please rate how often you have engaged in the following activities over the past six months: (1) Made purchases with environmental impact in mind; (2) Reduced energy consumption at home; (3) Looked for or read information about climate change; (4) Taken steps to reduce impacts of extreme weather events; (5) Discussed climate change with family and friends .	5-point scale (1 = never, 5 = very often); mean of 5 items

Table B3: Survey items used to capture outcomes in BART model and their coding.
Note: ***** The nuclear energy item was dropped from the Japanese scale because it was reverse-correlated with the scale.

Predictor	*Survey item(s)*	*Scale and coding*
SES		
Age	Using the dropdown list, please indicate your age.	Continuous (18–99+)
Gender (woman)	Please indicate your gender.	Binary (1 = woman, 0 = man/other)
Income	Please indicate if your household income, before taxes, falls into any of the following categories.	8-point ordinal (1 = no income, 8 = >$200,000)
Education	Please indicate the highest level of education you have attained.	11-point ordinal, recoded to 5 categories
Values		
Ideology	In politics, people sometimes talk of "left" and "right." Where would you place yourself on a scale from 1 to 7 where 1 means the left and 7 means the right?	7-point scale (1 = left, 7 = right)
NEP scale	6-item short form: e.g., "Humans are severely abusing the planet"; "Nature is strong enough to cope with the impact of modern industrial nations" (reverse-coded); "The balance of nature is very delicate and easily upset" (see Whitmarsh, 2008)	5-point agree–disagree; mean of 6 items
Free market	An economic system based on free markets unrestrained by government interference automatically works best to meet human needs.	5-point agree–disagree (1 = strongly disagree, 5 = strongly agree)
Individualism	2-item index: (1) "If the government spent less time trying to fix everyone's problems, we would all be a lot better off"; (2) "Even if some people are at a disadvantage, it is best for society to let people succeed or fail on their own."	5-point agree–disagree; mean of 2 items
Egalitarianism	2-item index: (1) "Society works best if power is shared equally"; (2) "It is our responsibility to reduce differences in income between the rich and the poor."	5-point agree–disagree; mean of 2 items
Hierarchy	2-item index: (1) "Society is in trouble because people do not obey those in authority"; (2) "Society would be much better off if the people in charge imposed strict and swift punishment on those who break the rules."	5-point agree–disagree; mean of 2 items
Trust		
Trust: news media	What is your level of trust or distrust in each of the following sources of information about political issues and related matters?	5-point scale (1 = strongly distrust, 5 = strongly trust)
	News media	
Trust: politicians	"…" Politicians	5-point scale (1 = strongly distrust, 5 = strongly trust)
Trust: scientists	"…" Scientists	5-point scale (1 = strongly distrust, 5 = strongly trust)
Trust: environmentalists	"…" Environmentalists	5-point scale (1 = strongly distrust, 5 = strongly trust)
Trust: international organizations	"…" International organizations	5-point scale (1 = strongly distrust, 5 = strongly trust)
Trust: energy companies	"…" Energy companies	5-point scale (1 = strongly distrust, 5 = strongly trust)

Predictor	*Survey item(s)*	*Scale and coding*
Trust: artificial intelligence	"…" Artificial intelligence	5-point scale (1 = strongly distrust, 5 = strongly trust)
Trust: social media	"…" Social media	5-point scale (1 = strongly distrust, 5 = strongly trust)
Climate		
Perceived temp. change	Over the course of your life, do you think local summer temperature has increased, stayed the same or decreased?	3-point scale (1 = decreased, 2 = same, 3 = increased)
Extreme weather harm	Over the past five years, many people have been affected by extreme weather events like extreme heat or cold, severe storms, major flooding, drought or water shortages, tornadoes, and wildfires or wildfire smoke. Have you personally experienced harm from any of these events in the past five years? If so, to what extent?	5-point scale (1 = never, 5 = a great deal)
Lifestyle		
Lifestyle: driving	Please indicate how important the following activities or behaviors are to you personally: Driving your personal car or truck for regular errands and activities.	5-point scale (1 = not important, 5 = extremely important); 0 if not applicable
Lifestyle: vacations	"…" Taking vacations in far-away destinations.	5-point scale (1 = not important, 5 = extremely important); 0 if not applicable
Lifestyle: phone upgrades	"…" Upgrading your phone when new models come out.	5-point scale (1 = not important, 5 = extremely important); 0 if not applicable
Lifestyle: meat	"…" Eating meat as part of your regular diet.	5-point scale (1 = not important, 5 = extremely important); 0 if not applicable
Lifestyle: single-use items	"…" Using single-use items like plastic water bottles, plastic straws and utensils.	5-point scale (1 = not important, 5 = extremely important); 0 if not applicable
Occupation (high carbon)	Which of the following best describes the field you work in?	Binary: 1 = agriculture/forestry/fishing, gas/electricity/water/mining, manufacturing/engineering, construction, or commerce/transport/food services

Table B4: Survey items used to capture covariates in BART model and their coding.

Section C – LCA

This section presents supplementary material for the latent class and BART analyses reported in the main text. Figure C1 displays the BIC curves used to select the optimal number of classes (*K*) for the full specification model in each country.

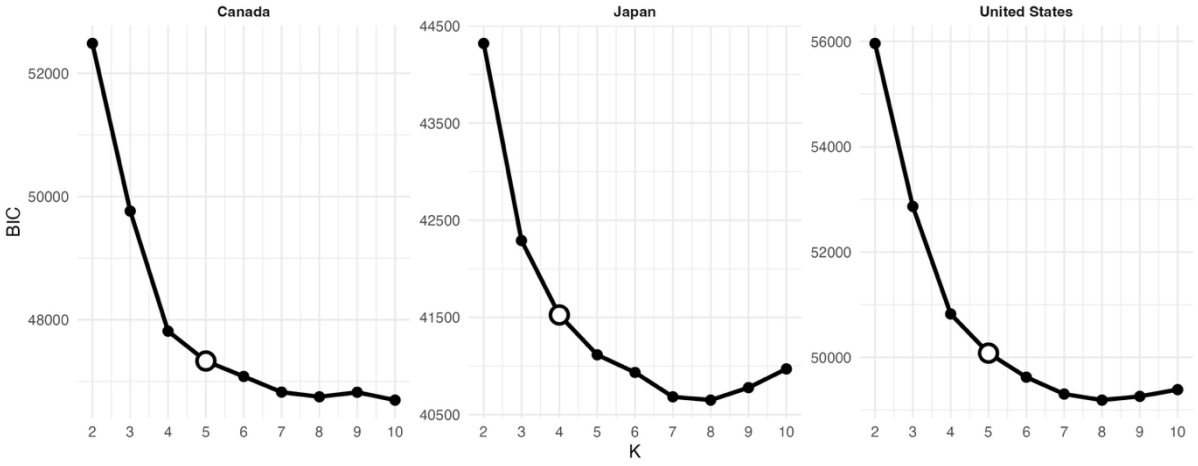


Figure C1: BIC curves and maximum deceleration point in improvement across *K* by country.

Section D – Supplementary Analyses on the Determinants of Climate Information

Below, I provide results from supplementary analyses that complement the main text's findings on the determinants of information profiles. Figures D1 and D2 show results from alternative variable selection approaches for BART based on the permutation-based method proposed by Bleich et al. (2014) and the Metropolis Importance (MI) approach proposed by Luo and Daniels (2024), which accounts for downward biases in variable importance estimates for categorical predictors when using mixed sets of continuous and categorical variables.

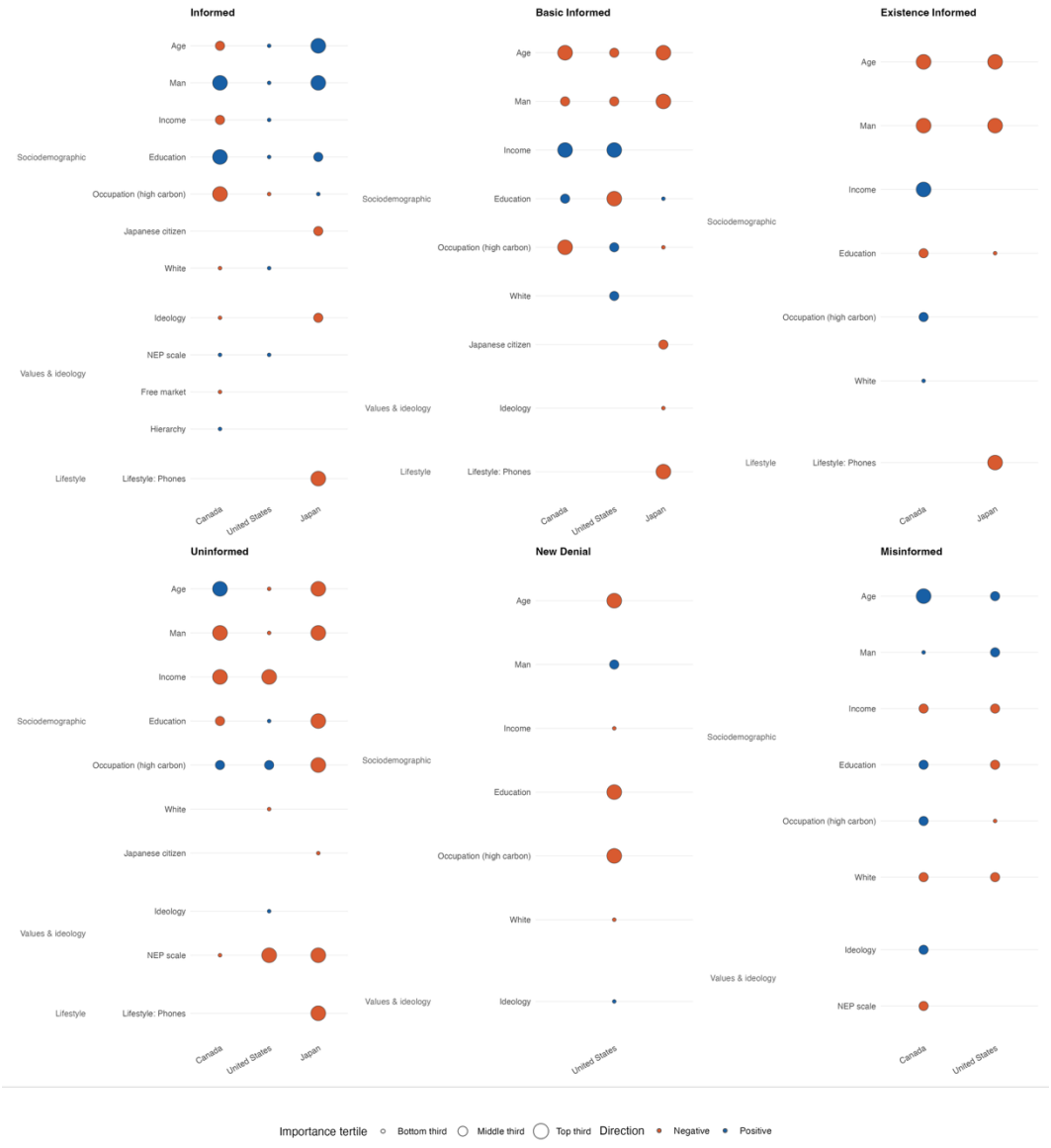


Figure D1: Variable importance scores for predictors of information profiles using the permutation-based approach based on Bleich et al. (2014).



Figure D2: Variable importance scores for predictors of information profiles using the Metropolis Importance (MI) approach based Luo and Daniels (2024).

As stated in the main text, both approaches yield a reduced set of predictors compared to the less strict $1/P$ approach employed there. This result is expected given that, as noted by Luo and Daniels (2024), such thresholds tend to be sensitive to correlated predictors. Because the approach used to examine predictors of profile membership adopts a “kitchen sink” strategy with many related predictors, these stricter thresholds may be less suitable for an exploratory analysis such as the present one.

Section E — Supplementary Analyses on the Role of Information Profiles as Predictors

This section provides results from supplementary analyses examining the role of information profiles as predictors of climate-related outcomes. Figure E1 presents results from BART models testing the associations between information profile membership and climate-related outcomes across all profiles and countries.

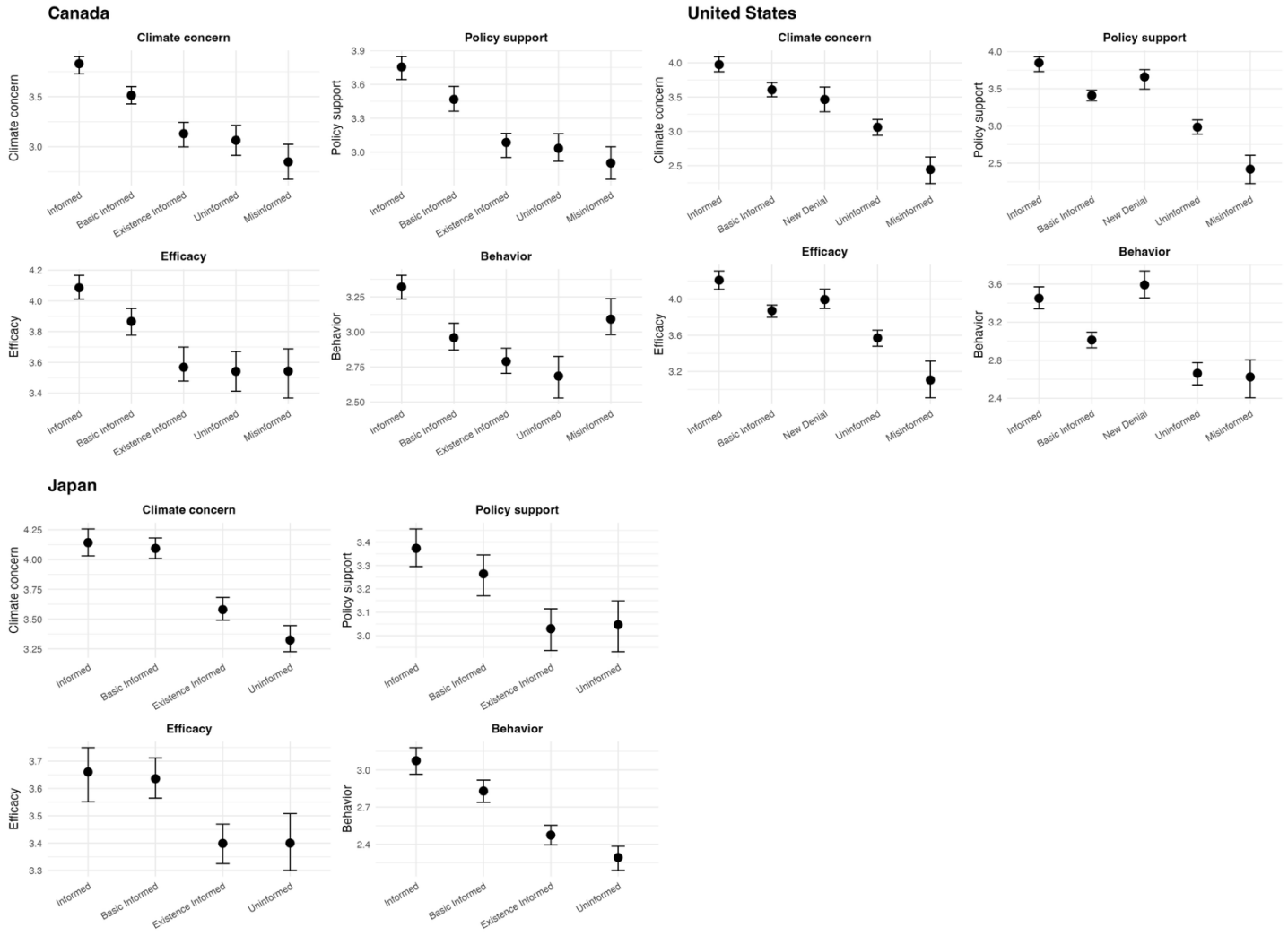


Figure E1: Relationships between profile membership and outcomes for all profiles across countries.