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IZA DP No. 17184

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Armand Sim
Monash University

Sarah Gultom
Monash University

Alyas Widita
Monash University

Wang-Sheng Lee
Monash University and IZA

Umair Khalil
Deakin University

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IZA – Institute of Labor Economics

Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany

Phone: +49-228-3894-0
Email: publications@iza.org

www.iza.org

ABSTRACT

Sink or Swim: Testing the Roles of Science and Religion in Raising Environmental Awareness in Indonesia*

Promoting awareness and encouraging pro-sustainability behaviors to mitigate climate and environmental issues can be challenging due to their polarizing nature. We conduct a large-scale online experiment in Jakarta, the world's fastest sinking city, to examine the impact of messenger identity and narrative style on awareness and behavior regarding land subsidence, a human-induced climate change phenomenon. We vary the messenger identity (an actor portraying either a religious leader or a scientist) and the narrative style of the message (religious vs. scientific). Our results show that exposure to an environmental video message, as opposed to a placebo, increases beliefs, trust in institutions, and pro-sustainability behaviors. The largest impacts arise when a scientist delivers a message embedded with a religious narrative. The effects are more pronounced among individuals with low prior knowledge, high trust in authorities, and those less reliant on groundwater. However, we find limited evidence of heterogeneous treatment effects on actions. Our findings highlight the importance of carefully considering both the message and the messenger in communication strategies in a diverse population.

JEL Classification: Q54, Q58, Z12

Keywords: land subsidence, environmental awareness, religion, science, Indonesia

Corresponding author:
Armand Sim
Centre for Development Economics and Sustainability
Monash University
Wellington Rd
Clayton VIC 3800
Australia

E-mail: armand.sim@monash.edu

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1 Introduction

Despite abundant scientific evidence of human activities' destructive impacts on climate change (IPCC, 2023), public opinion remains divided on its existence and severity, reflecting ideological differences (Egan and Mullin, 2017), religion-science tensions (Jenkins et al., 2018), misinformation, and resistance to behavioral changes (McLennan, 2024). This polarization hinders effective climate action, particularly in developing countries where limited resources and competing priorities exacerbate the challenge of building necessary public support.[1]

To address this challenge, policymakers should explore creative, persuasive, low-cost information campaigns that effectively reach diverse populations. Research has documented the effectiveness of such campaigns in promoting challenging policies, such as using influential figures to increase vaccination rates (Banerjee et al., 2020; Alatas et al., 2024) and moral suasion messages to boost energy conservation (Ito et al., 2018).[2] In the context of climate action, leveraging the influence of prominent figures like religious leaders and scientists holds promise. Many religions, especially Islam, emphasize pro-sustainability values that can shape environmental perspectives (Dien, 2000; Kula, 2001). In developing countries, where local cultural and religious values strongly shape behaviors (Bénabou and Tirole, 2016; Nunn, 2019), this approach may be particularly effective.[3] Additionally, exposure to scientific information and values has been shown to increase public support for climate action (e.g., Bruine de Bruin and Bostrom, 2013; Motta, 2018).

Building on this insight, we investigate the interplay between messenger identity and narrative style in shaping the effectiveness of environmental messages in promoting awareness and improving attitude. We ask two relatively underexplored questions:[4] (i) do messengers' identities

[1]For instance, polarization surrounding climate change has led to major political gridlock in the United States Congress (Dunlap et al., 2016; Egan and Mullin, 2017).

[2](Banerjee et al., 2020) use video messages featuring a Nobel laureate to increase COVID-19 vaccination rates, while (Alatas et al., 2024) use celebrity endorsements to boost child immunization rates.

[3]As discussed in Jenkins et al. (2018), many religious authorities have issued formal statements engaging with climate change. In 2015, global Islamic leaders drafted an Islamic Declaration on Climate Change, while in 2015 Pope Francis released the encyclical Laudato Si, highlighting climate change's moral significance in Catholic teaching. This movement also gained momentum in Indonesia, the largest Muslim-majority nation, where the government partnered with the largest Muslim organization to promote environmental conservation activities (Silalahi, 2022).

[4]Some recent exceptions include Buccione (2023) who finds that women who received a religious message on water conservation shifts their beliefs about water conservation and reduce their water consumption and Dechezleprêtre et al. (2022) who document effectiveness of different framing of climate policy via video messages on public support

matter more than the narrative style? (ii) can the interaction between messenger identity and message content generate larger gains? Addressing these questions is crucial for understanding belief formation and designing effective communication policies (Haaland et al., 2023), but it is challenging due to the possibility of messengers tailoring messages to align with audiences' preexisting beliefs and followers adopting their thought leaders' stances regardless of content, as suggested by the theory of motivated cognition (Bénabou and Tirole, 2016).[5]

To address these questions, in collaboration with Qualtrics, we conducted an online experiment with 3,002 participants in the Jakarta metropolitan area between July and August 2023, aiming to investigate the effectiveness of different narratives and presenters in influencing awareness and attitudes on land subsidence, a pressing human-induced climate change issue. The issue is characterized by the gradual sinking of the Earth's surface due to excessive groundwater consumption exacerbated by population growth, rapid urbanization, and more frequent droughts (Famiglietti, 2014; McDonald et al., 2014).[6] Land subsidence affects 22% of major cities worldwide, putting over 600 million people in flood-prone areas at risk by 2040 (Herrera-García et al., 2021). Jakarta, the world's fastest sinking city, is a dire example.[7] Some parts of it are predicted to be completely underwater by 2050, potentially devastating the metropolitan area's 31 million people and US$ 200 billion economy.[8] Studies show that further subsidence can be mitigated through policies that reduce groundwater stress (Herrera-García et al., 2021). However, alarmingly, many Jakarta residents remain largely unaware of the situation (Takagi et al., 2021).

We randomly exposed participants to an environmental video message embedded with different narratives (religious and scientific) delivered by different presenters (a single actor portrays both

across various countries. Both studies, however, do not explore the interaction between the messenger identity and message content.

[5]Wang et al. (2023) document evidence of motivated cognition theory in high-stakes college entrance exams. Chinese Muslim students who took the exam during Ramadan performed substantially worse than their peers. However, when these students were exposed to reading materials from respected Muslim clerics that permitted delaying fasting during the exam, they were less likely to distort the costs of fasting and became more accepting of postponing their fast.

[6]In the U.S., policies and urban planning often neglect subsidence in coastal areas despite its potential to worsen the impacts of sea-level rise (Ohenhen et al., 2024).

[7]See https://www.bbc.com/news/world-asia-44636934

[8]The threat of Jakarta sinking is one of the main reasons why the Indonesian government is relocating its capital to Nusantara, a new city planned on Borneo, the world's third-largest island situated 800 miles away (Beech, 2023).

an Imam, a Muslim religious leader, and a scientist), resulting in a 2×2 research design and a control group (placebo message).[9] Our outcomes of interest are beliefs about the causes and consequences of land subsidence, trust in the capacity of actions to address the issue, willingness to take actions to reduce groundwater extraction, support for mitigation policies, and perception of environmental disasters.[10]

The results demonstrate that exposure to the environmental video message generates significant positive effects on multiple outcomes. First, we establish that the treatment significantly increases the proportion of respondents who believe that land subsidence will ultimately result in Jakarta being completely submerged, and increases conviction that groundwater extraction drives land subsidence in Jakarta. Second, we also find positive effects on trust in the capacity of actions to address the land subsidence issue. Importantly, the positive effects on beliefs and trust translate to increased self-reported willingness to take action to reduce groundwater extraction. Third, and more interestingly, our findings reveal that the largest positive impacts arise when a scientist, as opposed to an Imam, utilizes a religious narrative to convey an environmental message. This combination, where a scientist delivers a religious message instead of a scientific one, makes participants find the actor more persuasive and trustworthy.

Heterogeneity analysis reveals several factors influencing the effectiveness of our intervention on beliefs and willingness to change behaviors. First, individuals with high initial knowledge about land subsidence are less likely to update their beliefs when the message is delivered by a scientist. Second, trust in authorities and personal circumstances, such as reliance on bottled water, significantly shape receptiveness to environmental messages. Third, the presenter's identity is particularly important when targeting specific religious groups, as demonstrated by the stronger response of Muslim participants to messages from an Imam. Finally, while increasing awareness is critical for those with limited prior knowledge, we do not find the same impacts on actions,

[9]We chose an actor portraying an Imam because it potentially has the largest appeal to our participants, given that Indonesia is the world's largest Islamic nation, with more than 80% of Jakarta metropolitan area residents self-identifying as Muslims. In our sample, more than 65% are Muslims.

[10]Our experimental design shares similarities with Dechezleprêtre et al. (2022), as both studies utilize informational videos in online surveys. However, while their research examines climate impacts and policies, our intervention addresses a more immediate environmental issue with significant medium-term consequences.

suggesting that information interventions alone may not translate awareness into action.

Overall, our results highlight the importance of a low-cost information campaign by combining the influence of prominent figures with different narratives to reach a wider audience. This intervention is especially relevant for phenomena that have no immediate, visible impacts but can lead to significant long-term problems, such as land subsidence. This has broader implications for Indonesia, where public opinion remains divided on climate change. The percentage of adults recognizing global warming as a serious problem demanding immediate action only increased from 31% to 36% over the last decade, while 18% deny human responsibility altogether (Bland et al., 2022).[11]

This study contributes to the literature on effective environmental communication strategies in several ways. First, Dechezleprêtre et al. (2022) show that different framings of climate policy information can affect public support across many countries, whereas Buccione (2023) finds significant positive impacts of religious messaging on water conservation behaviors among Jordanian female students. We extend these works by examining the interaction between messenger identity and message content. Second, we also address the challenges of communicating scientific information in a context where trust in academics and scientists may be limited (Alvarez et al., 2023). Lastly, we extend previous research on the importance of message sources in effective environmental communication (Fielding et al., 2020) to the context of developing countries, where access to information is limited (Spektor et al., 2023).

2 Background

2.1 Land Subsidence in Jakarta

Jakarta is the world's fastest-sinking city. In certain parts of the city, the rate of sinking, or land subsidence, is projected to reach 5 meters by 2050, further exacerbated by an estimated 25 cm of sea level rise (Kulp and Strauss, 2019). Figure A.1 illustrates the spatial extent of the rate of land

[11] https://www.theguardian.com/environment/2019/may/07/us-hotbed-climate-change-denial-international-poll

subsidence, indicating that areas in northern Jakarta are likely to be the most impacted by this issue.

The primary reason behind this phenomenon is the over-extraction of groundwater, which serves as the main water source for the city's residents (Asian Development Bank, 2016; Saputra et al., 2017; Bagheri-Gavkosh et al., 2021). The environmental impacts of excessive groundwater extraction, coupled with its unregulated and unregistered nature, have prompted both the government and concerned citizens alike to promote the adoption of piped water sources, primarily provided through PAM Jaya, a regional state-owned enterprise. Despite these efforts, as of early 2020s, piped water sources account for approximately only half of the total water consumption in Jakarta (Taftazani et al., 2022). In addition, other policy measures have also been adopted like lowering the fare of piped water subscription, building sea walls along Jakarta's coasts,[12] and expanding polder system and infiltration wells.[13]

On top of those measures, Jakarta's provincial governmental has restricted large buildings (>5,000 square meters, or 8 stories) from extracting groundwater.[14]In a similar vein, the national government through the Energy and Mineral Resources Ministry has set forth a regulation requiring households and enterprises to apply for a permit if they intend to extract 100 cubic meters of groundwater.[15]

The implementation of the above measures indicate that land subsidence is indeed garnering attention from policy circles. However, surprisingly overlooked, or even completely absent, are efforts and policies on augmenting public understanding and awareness about the severity of this issue. For instance, our sample indicates that while 78% of the control group believes that land subsidence is a serious problem facing Jakarta, only 66% attribute it to human agency via extraction of groundwater.

[12]https://www.theguardian.com/cities/2016/nov/22/jakarta-great-garuda-seawall-sinking

[13]https://megapolitan.kompas.com/read/2021/09/02/18181151/7-kebijakan-dki-jakarta-untuk-cegah-jakarta-tenggelam-di-2050

[14]Implemented through Governor's Regulation (*Peraturan Gubernur*) Number 93 of 2021 on Groundwater-Free Zones. See https://peraturan.bpk.go.id/Details/195633/pergub-prov-dki-jakarta-no-93-tahun-2021

[15]https://jdih.esdm.go.id/index.php/web/result/2404/detail

2.2 Islam and the Environment

Indonesia has a predominantly Muslim population, with approximately 87 % of its people identifying as Muslim. Islam significantly influences Indonesians' daily lives, including their political and environmental attitudes and behaviors (Sumaktoyo, 2021; Gade, 2015). Indeed, local religious leaders have periodically contributed to environmental debates through an Islamic lens (Wee, 2024). For example, the Indonesian Council of Ulama (*Majelis Ulama Indonesia*, or MUI), the country's top Muslim clerical body, has issued a fatwa declaring that environmental protection is a religious duty. Similarly, Muhammadiyah, a leading Islamic organization, launched the Eco Bhineka program in 2020 to promote environmental protection across faiths under the Joint Initiative for Strategic Religious Action (JISRA). Another large Islamic organization, Nadhlatul Ulama, has partnered with the Indonesia's Ministry of Environment and Forestry to enhance environmental conservation activities.

These efforts draw upon a rich corpus of sources within Islamic thought and formal jurisprudence, developed over centuries since the birth of Islam. The Quran, the holy book of Islam, contains at least 80 verses emphasizing the importance of environmental conservation and earth protection (Aboul-Enein, 2018). The Hadith (sayings of Muhammad, the prophet of Islam) also echoes similar narratives applicable to environmental protection in contemporary Muslim societies. A few examples illustrate this point. These range from enjoining believers towards conservation (...and eat and drink, but be not excessive. Indeed, He likes not those who commit excess," *Quran, 7:31*) to prescriptions on the importance of planting trees (If a Muslim plants a tree,..., and then a bird, or a person, or an animal eats from it, it is regarded as a charitable gift for him [in perpetuity]," *Sahih Bukhari, Vol 3, Book 39, No. 513*)[16]. Additionally, countless rulings by religious scholars across time and space have established environmental protection and conservation as religious acts for practicing Muslims.

Our approach in this paper is motivated by the prevalence of these three interlinked features in Indonesian society: a large Muslim population, local Ulama's willingness to engage positively

[16]A sterner warning is provided in another hadith: "If anyone cuts the lote tree (a large shade tree species), Allah brings him headlong into Hell" (*Sunan Abi Dawud 5239, Book 43, Hadith 467*)

with environmental debates, and the existence of a substantial corpus of environmentally focused Islamic literature. Together these inform the development of our experimental design by leveraging the role of religious narratives in designing environmental awareness campaigns.

3 Research Design

Sampling frame. Our target population consists of residents of Jakarta and its surrounding areas, including Bogor, Depok, Tangerang, and Bekasi (Bodetabek). We selected these areas because Jakarta residents face immediate consequences from land subsidence, while residents in the surrounding areas are also likely to be impacted due to their reliance on sustainability of Jakarta's infrastructure. For example, approximately 1.25 million people from Bodetabek—about 11 % of Jakarta's population—commute to Jakarta for work every day (Statistics Indonesia, 2019). We recruited our participants from a Qualtrics panel of respondents. Our nationally representative sample consists of 3,002 individuals aged 18 and above, with equal gender representation and varying levels of education, income, and religion.

Treatments. This study has three goals. First, to test whether an informational video message regarding land subsidence, compared to a placebo, can effectively influence environmental awareness, beliefs, as well as generate policy support. Second, to isolate the effect of the narrative (religious or scientific) from the presenter's identity (Imam or scientist). Third, to identify the most effective combination of presenter identity and narrative in delivering the message.

To this end, we designed a 2×2 experiment along with a control group (see Figure A.2). We cross randomize the presenter identity (Imam vs. climate change scientist—hereafter referred to as scientist) and the narrative (religious vs. scientific) to create four treatment groups. The control group is exposed to a placebo video message. To ensure a fair comparison, the environmental and placebo video messages are designed to have roughly the same duration. In each of the treatment groups, participants are exposed to a video message that lasts for roughly 3.5 minutes, which consists of 2.5 minutes of an environmental message followed by a 1-minute religious or scientific

narrative. Each participant was randomly assigned to one of the following groups.

- **Treatment 1 (Imam × Religious).** Participants in this group were exposed to an Imam presenting an environmental message video embedded with a religious narrative.
- **Treatment 2 (Imam × Scientific).** Participants in this group were exposed to an Imam presenting an environmental message video embedded with a scientific narrative.
- **Treatment 3 (Scientist × Scientific).** Participants in this group were exposed to a scientist presenting an environmental message video embedded with a scientific narrative.
- **Treatment 4 (Scientist × Religious).** Participants in this group were exposed to a scientist presenting an environmental message video embedded with a religious narrative.
- **Control.** Participants in this group were exposed to a placebo video message, about the general history of Jakarta, without a presenter.

Intervention details. We hired an actor to appear both as a Muslim religious leader (an Imam) and a scientist to present each video message. This will ensure that subconscious individual-level body language, potentially independent of the actor's role, remains consistent across both treatments. We vary the identity of the presenter, by modifying two features: his appearance and the greetings used. The Imam wears a white shirt, a short rounded skullcap (*taqiyah* or *kufi*) and a scarf covering the shoulder and greets the viewers with a common Islamic greeting (*Assalamualaikum warahmatullahi wabarakatuh* or *Peace be upon you, and mercy and blessings of God*), whereas the scientist wears a casual shirt and glasses and greets the viewers with a secular greeting, free from any religious attributes. To avoid a possible bias linked to the presenter, we did not display any references or any affiliations in the video.[17] The actor was tasked to deliver the following information.[18]

[17] All videos can be found here.

[18] The scripts for each message and narrative are shown in the Appendix B. We collaborated with a professional copywriter to write each script to ensure that the video can convey the message clearly to participants.

Environmental message. This message provides factual information regarding land subsidence (e.g., concrete statistics on land subsidence, like North Jakarta has fallen 2.5 meters in the last decade) and issues related to groundwater extraction in Jakarta. To help viewers understand the scale of the issue, we also show visual information regarding the causes (e.g., groundwater extraction) and consequences (e.g., flooding and sinking ground) of the land subsidence problem.[19] This approach addresses gaps in knowledge and misconceptions, aligning with guidelines on effective science communication (Bruine de Bruin and Bostrom, 2013).

Narratives. The religious narrative leverages Islamic principles and scriptures to promote environmental awareness among participants. It also highlights the importance of joint efforts between Muslims and the government in preserving nature and the environment. On the other hand, the scientific narrative highlights findings from academic research on the dire consequences of land subsidence in Jakarta to influence participants' environmental awareness. This approach frames environmental actions in terms of societal benefits, allowing us to test the effectiveness of different framing strategies as suggested by Bain et al. (2012).

4 Data and Empirical Strategy

4.1 Survey Data

Data was collected between July and August 2023 through the online survey platform of Qualtrics. The survey measured pre-specified outcomes related to participants' environmental attitudes and behaviors, focusing on beliefs regarding the causes (excessive groundwater extraction) and consequences (submergence of Jakarta) of land subsidence, willingness to take mitigating actions, policy support, trust in institutions (e.g., religious leaders, scientists, governments) regarding subsidence, and environmental threat perception. In addition, the survey also measured socio-economic characteristics, climate change risk perception, drinking and non-drinking water sources,

[19] Interventions that provide social consequences of an individual's behavior, such as our informational video experiment, rely on the assumption that people have prosocial preferences and are driven by a desire to help others (Toledo, 2016).

and groundwater usage among other predictors of the main outcomes.[20] All outcome variables, with the exception of beliefs, consist of several pieces of related information.[21] To address the multiple hypothesis testing problem, we constructed the indices following Anderson (2008). Detailed variable definitions can be found in Table C.1.

4.2 Descriptive Statistics and Balance Tests

Table 1 presents summary statistics and balance tests. Our sample consists of 3,002 individuals aged 18 and above, with a slight majority of females and, unsurprisingly, most participants identifying as Muslim. Education levels vary, but more than 60% have either attended or graduated from university. Even though about 80% of participants have access to PDAM (the government owned water utility company), a large proportion rely on bottled water for drinking, indicating low confidence in PDAM water quality. We follow Imbens and Rubin (2015) to verify the balance of our sample by calculating the standardized differences for each covariate across groups. None of the standardized differences exceed the rule-of-thumb cutoff of 0.25 SD, indicating that the randomization was successful.[22]

4.3 Empirical Strategy

To test the impacts of exposure to different environmental video messages, each with a different presenter and narrative, we estimate the following straighforward regression specification:

$$\begin{aligned} y_i = \beta_0 + \beta_1 \text{Imam}_i \times \text{Religious}_i + \beta_2 \text{Imam}_i \times \text{Scientific}_i + \\ \beta_3 \text{Scientist}_i \times \text{Religious}_i + \beta_4 \text{Scientist}_i \times \text{Scientific}_i + \mathbf{X}_i' \gamma + \varepsilon_i \end{aligned} \tag{1}$$

where y_i is the outcome of participant i, Imam_i and Scientist_i are indicators for whether a

[20] A pilot study with 50 participants was conducted in June 2023 through Qualtrics to refine survey questions and interventions.

[21] For example, the action index is derived from questions about willingness to decrease groundwater use, install piped water, and relocate for better water access.

[22] The randomization exercise was undertaken by Qualtrics itself. Their survey platform has a built-in feature that ensures that participants are randomized correctly across survey arms.

participant was exposed to a video message presented by an Imam or a scientist. Religious_i and Scientific_i are indicators for whether a participant was exposed to a video message with embedded religious or scientific narratives. X_i is a vector of socio-economic control variables shown in Table 1. We do not cluster standard errors, ε_i, because randomization is at the individual level (Abadie et al., 2023).

Each coefficient of interest, β_1, β_2, β_3, and β_4 compares a treatment arm to the control group—participants exposed to a placebo video—representing average treatment effects of exposure to an environment-related informational video with a particular combination of message and messenger. β_1 and β_2 capture the effects of an Imam presenting environmental messages embedded with a religious and a scientific narrative, respectively. Similarly, β_3 and β_4 measure the impacts of a scientist delivering environmental messages with a religious and a scientific narrative, respectively.

We expect exposure to a video message about environmental issues to improve participants' understanding, shape their beliefs, and increase their engagement as well as support for policies addressing land subsidence issues in Jakarta. This expectation is based on the video's detailed information about the causes and consequences of this potential environmental catastrophe and our respondents' relatively low baseline familiarity with the issue—approximately 47 % reported being familiar with it.[23]

Our analysis goes beyond comparing the impact of an environmental video to a placebo. To examine the importance of the presenter's identity, we compare their impact when delivering different narratives. The differential impact of the presenter identity (Imam vs. scientist) when presenting *a religious narrative* is *Religious* $\times$ (*Imam* - *Scientist*), which is given by $(\beta_1 - \beta_3)$. Similarly, the effect of the presenter identity when presenting *a scientific narrative* is *Scientific* $\times$ (*Imam* - *Scientist*), which is given by $(\beta_2 - \beta_4)$.

To examine the importance of the narrative, we compare its impact when delivered by different presenters. The differential impact of a narrative when presented by *an Imam* is *Imam* $\times$ (*Religious* - *Scientific*), which is given by $(\beta_1 - \beta_2)$, while *Scientist* $\times$ (*Religious* - *Scientific*), which is given by $(\beta_3 - \beta_4)$, captures the differential impact when presented by *a scientist*. We also evaluate the

[23] About 31 % and 16 % answered "Knowledgeable" and "Extremely knowledgeable".

difference-in-differences estimator (*Imam-Scientist*) $\times$ (*Religious-Scientific*) to isolate the effect of the presenter identity (Imam vs. scientist), independent of the narrative (religion vs. science).

Hypothesis. Cognitive authority theory posits that individuals are more likely to accept information from a source they perceive as an expert (Wilson, 1983). Therefore, we predict that the combination of perceived expertise of the presenter and narrative will have the largest impacts; the Imam's presentation of the religious narrative and the scientist's presentation of the scientific narrative are likely to be the most effective combinations. However, the impacts of the scientist presenting the religious narrative and the Imam presenting the scientific narrative are less predictable. According to this theory, it is hypothesized that these combinations will have smaller impacts compared to the Imam presenting the religious narrative and the scientist presenting the scientific narrative, respectively.

5 Results

5.1 Main Results

Our main findings, as reported in Table 2, show that exposure to the environmental video message, compared to the placebo video, significantly influences participants' attitudes and behaviors. Column 1 shows significant positive impacts on the belief that Jakarta will ultimately be submerged. The effect is substantially larger when the message is delivered by a scientist compared to an Imam. Treatment 3 (*Scientist* $\times$ *Scientific*) and Treatment 4 (*Scientist* $\times$ *Religion*) have the largest effects—10 percentage points (pp) and 11.4 pp respectively—nearly twice as large as the effects of the message presented by an Imam (Treatments 1 and 2). Column 2 reports that, consistent with the message delivered in the video, all treatment arms also significantly increased the belief that groundwater extraction contributes to land subsidence, especially when the video message is embedded with religious narrative and is delivered by a scientist as opposed to an imam (10.6 pp vs 7.2 pp).

The video message, which explains the steps taken by the Indonesian government to reduce

dependence on groundwater usage, also increases trust in the capacity to address land subsidence issues (Column 3). This result is mainly driven by an increased trust in themselves, the government, scientists, and Imams (when the message is delivered by an Imam) (Table A.1). Importantly, the increased awareness of the issue and the role of human agency in it as well as the induced increase in the trust index, also leads to a greater willingness to take concrete actions to reduce groundwater extraction (Column 4). These include acts such as cutting back on household water use, spreading awareness among friends, family, and neighbors about the negative impacts of overusing groundwater, and connecting to the local water utility (PDAM) when possible (Table A.2).

Given the positive impacts on overall trust, it is natural to expect that the video message may also increase support for policies to tackle land subsidence issues. We, however, document weaker impacts on support for such policy initiatives as shown in Column 5.[24] This is possibly due to the fact that the video does not provide detailed information about the government's policies to address the land subsidence issue. This finding aligns with Dechezleprêtre et al. (2022) who find significant impacts of video messages only when the message explains how climate policies work and its distributional implications. Finally, we do not find significant impacts on the perception of environmental threats (Column 6) and its index components (Table A.5).

Overall, these findings demonstrate that targeted environmental video messaging can shape attitudes and behaviors related to environmental issues, especially on beliefs and willingness to take concrete actions. In contrast to our predicted hypotheses, the scientist delivering an environmental message with both the scientific and religious narrative has the largest impacts on those outcomes compared to when delivered by an Imam. On the other hand, we do not find any significant differential impacts of the narratives.

The Role of Perception. The results suggest that the presenter's perceived expertise in explaining land subsidence issues may be more influential than the alignment between their identity and narrative style. Figure 1 supports this conclusion. Even though the same actor portrayed

[24]Table A.3 shows some support for imposing taxes on groundwater use but the result is not robust to the multiple hypothesis adjustment (sharpened q value > 0.1).

both roles, the scientist was considered more persuasive than the Imam when delivering both the religious (p=0.001) and scientific (p=0.086) narratives. Table A.1 suggests that participants' high perceived expertise towards the scientist may be due to their high trust in scientists. Column 7 shows increased trust in scientists across all treatment arms, whereas Column 6 reveals that increased trust in Imams is only observed when participants were exposed to an Imam delivering the message. These findings are consistent with a recent cross-country study that demonstrates high public trust in scientists in Indonesia (Cologna et al., 2024).

On the other hand, the alignment between identity and narrative style appears to be considered slightly more effective for the scientist than the Imam. The scientist is perceived as more convincing when delivering a scientific narrative, although the difference is not statistically significant (p=0.800). We find the opposite pattern for the Imam. Due to data limitations, however, we cannot further explore the reasons for these differences.

5.2 Heterogeneous Treatment Effects

To identify specific subgroups that are more responsive to our intervention, we examine heterogeneous treatment effects by pre-specified baseline characteristics: knowledge of land subsidence, trust in authorities' ability to address the issue, experience with environmental issues, indicators for main source of drinking water, for identifying as a Muslim, and for being a female.[25] We focus on outcomes significantly affected by the intervention with important implications for policy design: beliefs about the existence of land subsidence and the role of groundwater extraction as its main driver, and participants' willingness to adopt mitigating actions. Understanding factors influencing public awareness can help identify strategies for increasing support for policies addressing the issue, while understanding willingness to adopt mitigating actions is crucial for developing effective policies aimed at changing individual behaviors.

The results for each outcome are reported in Panels, A, B, and C of Table 3. Panel A shows that treatment effects on belief about the severity of land subsidence are significantly lower among individuals who initially had high (above median) levels of knowledge about the issue—23.45 % of

[25]For brevity, we do not include other secondary heterogeneity analyses.

our participants reported having little knowledge about the issue.[26] The heterogeneous results are only significant when a scientist delivers the message, irrespective of the narrative style.

We also find that exposure to environmental message has stronger impacts on participants with higher trust levels, suggesting a crucial role of trust in various authorities in shaping individuals' receptiveness of information on this issue. We observe mixed evidence on the role of personal experience. While we do not observe differential impacts based on experience with environmental issues, we find that those who rely on bottled drinking water (66.2 % of our sample) responded more to the treatments, suggesting that those less dependent on groundwater are more easily convinced by the message. As suggested by the theory of motivated cognition (Bénabou and Tirole, 2016), Muslim participants (67.6 % of our sample) responded more to environmental message delivered by an Imam, suggesting the importance of messenger identity in communication targeting a major religious group even though the effects do not significantly differ across treatment groups. Finally, we also document a gender gap in receptiveness to environmental message, with stronger effects documented among female participants.

We document a rather similar pattern in heterogeneous effects on the belief that groundwater extraction contributes to land subsidence (Panel B). The treatment effects are concentrated among participants with low initial knowledge about the issue, with the largest impact observed when the scientific narrative was delivered by a scientist, 13.6 pp or 20.5 % increase over the control mean. Consistent positive heterogeneous responses across groups are also observed among those who rely on bottled drinking water. Panel C reveals a divergence in the treatment effects on beliefs and actions based on participants' initial knowledge. While the treatment effects on beliefs about the severity of the issue are more pronounced among individuals with low initial knowledge, the willingness to take concrete action is higher among those with greater initial understanding of the problem, although the results are only marginally significant. This finding suggests that increasing awareness about the severity of the issue is critical for those with limited prior knowledge, but translating this awareness into action may require a different type of intervention.

[26] In our survey, 3.6 % reported having no knowledge about land subsidence in Jakarta while 19.85 % are slightly knowledgeable.

6 Conclusion

This paper experimentally studies the relative importance of the messenger identity and narrative style of an environmental video message in shaping environmental attitudes and behaviors related to land subsidence—a major environmental threat—in Jakarta, Indonesia. We find three main results. First, exposure to an environmental video message, compared to a placebo video, shifts environmental beliefs, attitudes, and behaviors. Second, the presenter identity, especially when presented by a scientist, plays a more significant role than the narrative style of the message in influencing beliefs about the causes and consequences of land subsidence, trust in the capacity to address the issue, and willingness to take concrete actions to reduce groundwater extraction. The largest impacts arise when a scientist delivers a message embedded with a religious narrative. The impacts on policy support and environmental threat perception are weaker.

Third, we document heterogeneous treatment effects on individuals' beliefs and actions. Individuals with low initial knowledge are more receptive to updating their beliefs when the message comes from a scientist. Trust in authorities and personal circumstances, such as reliance on bottled water, also shape individuals' responsiveness. Personal experience with environmental issues (e.g., floods) does not seem to matter. As predicted by theory of motivated cognition, the presenter identity is particularly crucial when targeting specific religious groups. However, we find limited heterogeneous treatment responses on actions. While increasing awareness is essential for those with limited prior knowledge, translating awareness into action may require additional measures beyond information interventions.

Overall, these findings provide two important lessons. First, conveying an environmental message through a video that displays uncensored damages due to environmental issues and how human actions contribute to them can significantly influence individuals' beliefs and behaviors. Second, the perceived expertise of the presenter in explaining the issue may be more important than the alignment between the presenter identity and the narrative style. These findings suggest that policymakers should consider the importance of credible scientists in delivering environmental messages and using different narrative styles to embrace individuals from different subgroups,

especially in a country with divided public opinion on environmental and climate issues.

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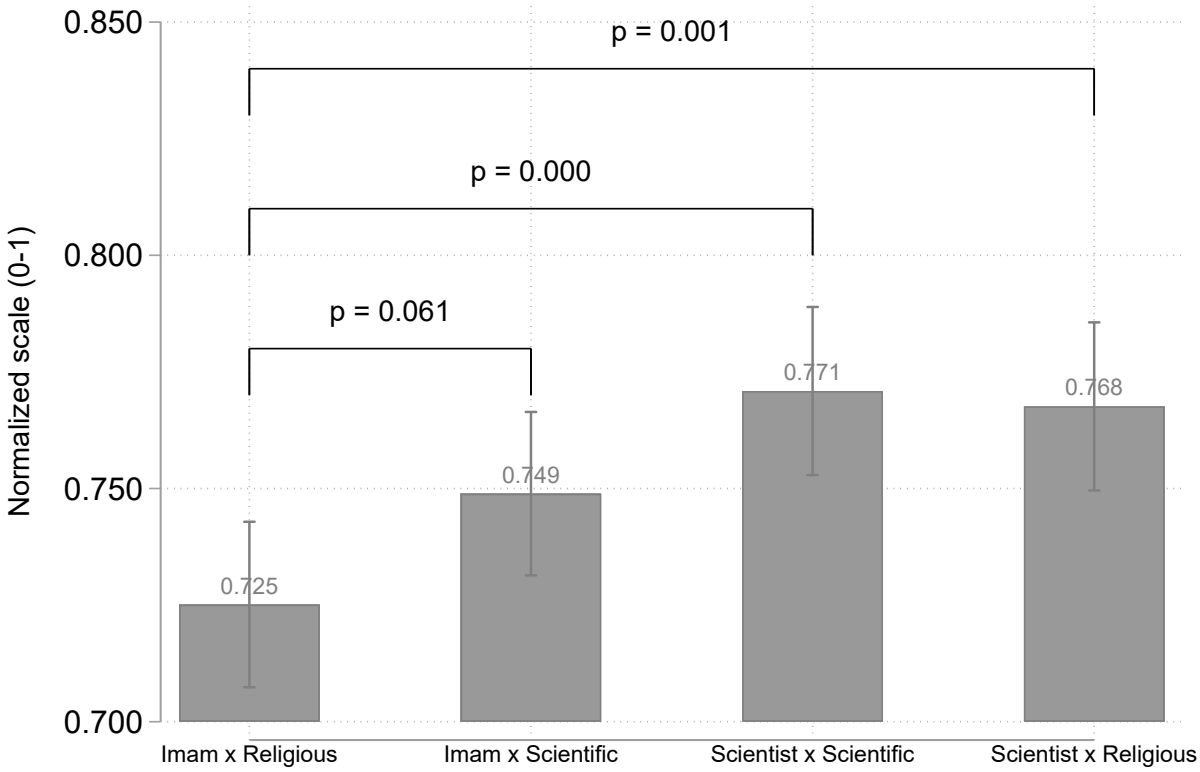
Main Figures and Tables

Figure 1: Perceived Persuasiveness Ability of Presenters



Note: The figure displays the raw mean values and 95% confidence intervals for the persuasiveness ability of presenters delivering an environmental message. The persuasiveness ability is derived from Likert scale responses evaluating how effectively the presenters convey the environmental message and influence opinions on land subsidence. The Likert scale is normalized to have support between 0 and 1. The p-values above the connecting lines indicate statistical significance for mean comparisons between treatment groups: 0.061 for "Imam × Religious" vs. "Imam × Scientific"; 0.000 for "Imam × Religious" vs. "Scientist × Scientific"; 0.001 for "Scientist × Scientific" vs. "Scientist × Religious"; 0.086 for "Imam × Scientific" vs. "Scientist × Scientific"; 0.144 for "Imam × Scientific" vs. "Scientist × Religious"; and 0.800 for "Scientist × Scientific" vs "Scientist × Religious".

Table 1: Balance and Summary Statistics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Mean					Standardized mean difference			
	N	C	T1	T2	T3	T4	T1 - C	T2 - C	T3 - C	T4 - C
Aged 18–23	3002	0.207	0.212	0.190	0.117	0.191	0.015	0.042	0.245	0.038
Aged 24–39	3002	0.313	0.283	0.335	0.321	0.313	0.065	0.047	0.017	0.001
Aged 40–54	3002	0.261	0.322	0.290	0.263	0.291	0.135	0.066	0.004	0.068
Aged 55+	3002	0.220	0.182	0.185	0.299	0.205	0.094	0.086	0.182	0.037
Female	3002	0.480	0.530	0.548	0.482	0.532	0.098	0.136	0.003	0.104
Edu: Elementary or lower	3002	0.013	0.019	0.033	0.022	0.013	0.044	0.134	0.066	0.002
Edu: High school	3002	0.349	0.376	0.303	0.306	0.364	0.056	0.098	0.092	0.032
Edu: University or higher	3002	0.638	0.605	0.663	0.672	0.622	0.067	0.054	0.073	0.032
Employed	3002	0.839	0.828	0.833	0.855	0.847	0.030	0.016	0.042	0.021
Main drinking water: bottled water	3002	0.674	0.685	0.695	0.599	0.657	0.023	0.046	0.156	0.035
Installed PDAM	3002	0.830	0.784	0.802	0.826	0.802	0.115	0.072	0.009	0.071
Islam	3002	0.693	0.703	0.698	0.610	0.674	0.021	0.011	0.175	0.042
Christian Catholic	3002	0.079	0.067	0.075	0.085	0.085	0.043	0.014	0.024	0.022
Christian Protestant	3002	0.126	0.120	0.125	0.159	0.126	0.020	0.004	0.093	0.001
Other religion	3002	0.102	0.110	0.102	0.145	0.115	0.026	0.000	0.133	0.042
Income: $<$ IDR 5 mil.	3002	0.239	0.226	0.197	0.196	0.191	0.032	0.103	0.106	0.117
Income: IDR 5 - 9.99 mil	3002	0.361	0.388	0.405	0.413	0.426	0.056	0.091	0.108	0.134
Income: $>$ 10 mil.	3002	0.400	0.386	0.398	0.391	0.383	0.028	0.003	0.018	0.035
HH size: small(1–2)	3002	0.139	0.160	0.117	0.151	0.140	0.058	0.068	0.032	0.001
HH size: medium(3–4)	3002	0.638	0.578	0.627	0.617	0.619	0.122	0.023	0.043	0.039
HH size: big(5+)	3002	0.223	0.261	0.257	0.232	0.241	0.090	0.079	0.023	0.043
Bekasi, regency	3002	0.038	0.056	0.050	0.043	0.042	0.085	0.060	0.029	0.020
Bekasi, city	3002	0.056	0.062	0.060	0.074	0.070	0.028	0.018	0.073	0.058
Bogor, regency	3002	0.057	0.046	0.057	0.045	0.047	0.054	0.003	0.055	0.049
Bogor, city	3002	0.036	0.042	0.037	0.054	0.048	0.031	0.003	0.084	0.061
Depok	3002	0.044	0.047	0.063	0.048	0.068	0.014	0.085	0.020	0.104
West Jakarta	3002	0.164	0.155	0.170	0.181	0.158	0.024	0.016	0.044	0.016
Central Jakarta	3002	0.200	0.167	0.153	0.167	0.153	0.085	0.122	0.085	0.123
South Jakarta	3002	0.110	0.128	0.132	0.130	0.135	0.057	0.067	0.063	0.076
East Jakarta	3002	0.133	0.145	0.132	0.135	0.128	0.035	0.003	0.008	0.014
Own current house	3002	0.757	0.764	0.763	0.704	0.770	0.015	0.014	0.120	0.031

Notes: The table reports summary statistics and balance test across treatment and control groups. Columns 2 to 5 report mean of baseline covariates—variables constructed from questions asked prior to video message exposure—of C (Control), T1 (Imam $\times$ Religion), T2 (Imam $\times$ Science), T3 (Scientist $\times$ Science), and T4 (Scientist $\times$ Religion) groups, respectively. Columns 7 to 10 report standardized difference in mean between each treatment and control group.

Table 2: Environmental Attitude and Behaviors

	(1)	(2)	(3)	(4)	(5)	(6)
	Belief on land subsidence	Belief on harmful groundwater extraction impact	Trust index	Action index	Policy support index	Perception index
Panel A						
Imam × Religious	0.062***	0.072***	0.162***	0.119**	0.066	−0.022
	(0.022)	(0.013)	(0.053)	(0.053)	(0.050)	(0.056)
Imam × Scientific	0.061***	0.088***	0.130**	0.161***	0.088*	0.013
	(0.022)	(0.013)	(0.054)	(0.051)	(0.049)	(0.055)
Scientist × Scientific	0.100***	0.102***	0.145***	0.173***	0.077	0.032
	(0.021)	(0.014)	(0.054)	(0.053)	(0.051)	(0.056)
Scientist × Religious	0.114***	0.106***	0.116**	0.210***	0.111**	0.029
	(0.021)	(0.013)	(0.053)	(0.051)	(0.050)	(0.055)
Panel B						
Imam × (Religious - Scientific)	0.001	−0.016	0.032	−0.043	−0.021	−0.035
	(0.020)	(0.013)	(0.053)	(0.052)	(0.048)	(0.055)
Religious × (Imam - Scientist)	−0.052***	−0.034***	0.045	−0.091*	−0.044	−0.051
	(0.019)	(0.012)	(0.052)	(0.051)	(0.050)	(0.054)
Scientific × (Imam - Scientist)	−0.039**	−0.015	−0.015	−0.011	0.011	−0.019
	(0.019)	(0.013)	(0.054)	(0.052)	(0.049)	(0.055)
Scientist × (Religious - Scientific)	0.015	0.004	−0.028	0.037	0.034	−0.003
	(0.018)	(0.013)	(0.053)	(0.052)	(0.050)	(0.054)
(Imam - Scientist) × (Religious - Scientific)	−0.014	−0.019	0.060	−0.080	−0.055	−0.032
	(0.027)	(0.018)	(0.075)	(0.073)	(0.070)	(0.077)
N	3,002	3,002	3,002	3,002	3,002	3,002
R^2	0.057	0.154	0.175	0.213	0.311	0.067
Control mean	0.787	0.662	0.000	0.000	0.000	0.000
Test of equality (p-value)						
Imam × Religious = Imam × Scientific	0.954	0.215	0.545	0.409	0.656	0.521
Scientist × Religious = Scientist × Scientific	0.410	0.779	0.594	0.474	0.503	0.950

Notes: Dependent variable in column 1 is an indicator for whether a participant believes that land subsidence will lead to submergence of Jakarta, while column 2 measures belief on harmful groundwater extraction impact, measured using Likert scale and normalized to have response between 0 and 1. In column 3-6, the index variables are constructed using multiple components and standardized with control as the reference group. All regressions include control variables such as age group, female, education level, employed, main drinking water: bottled water, installed piped water, religion, income level, household size, residence and home ownership. Standard errors are robust to heteroskedasticity. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3: Heterogeneous Treatment Effects on Beliefs and Willingness to Take Action

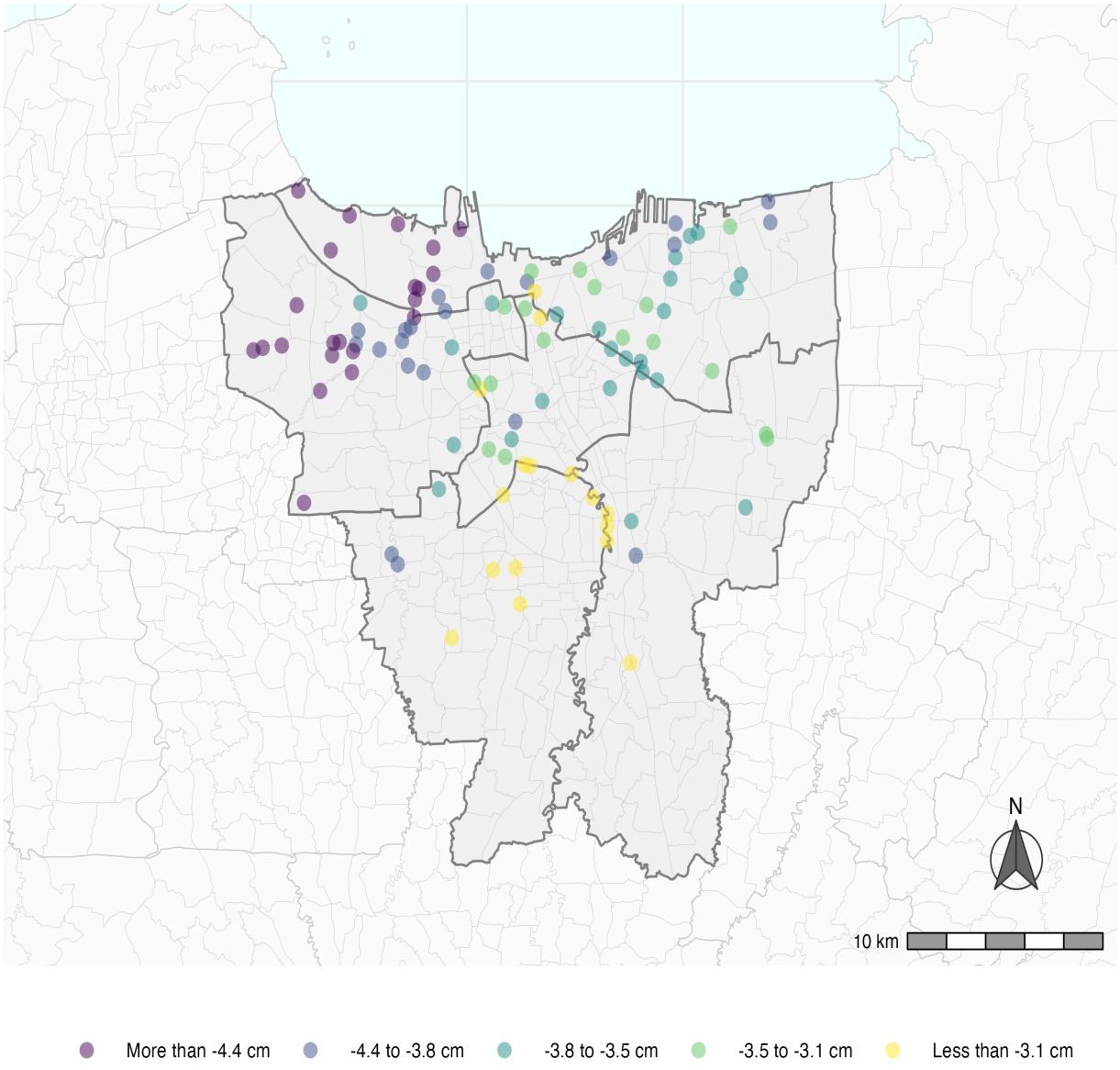
	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline [...]					
	High knowledge	High trust	High experience with environmental issues	Bottled water for drinking	Islam	Female
Panel A: Belief on existence of land subsidence						
Imam × Religious × [...]	−0.055	0.086**	0.026	0.082*	0.123**	0.086**
	(0.057)	(0.044)	(0.045)	(0.044)	(0.048)	(0.044)
Imam × Scientific × [...]	−0.082	0.092**	−0.059	0.137***	0.089*	0.133***
	(0.056)	(0.044)	(0.045)	(0.045)	(0.048)	(0.044)
Scientist × Scientific × [...]	−0.114**	0.064	−0.039	0.160***	0.066	0.106**
	(0.055)	(0.042)	(0.043)	(0.042)	(0.044)	(0.042)
Scientist × Religious × [...]	−0.120**	0.093**	−0.024	0.108***	0.064	0.067
	(0.052)	(0.041)	(0.043)	(0.041)	(0.044)	(0.041)
Panel B: Belief on impact of groundwater extraction						
Imam × Religious × [...]	−0.089***	−0.000	0.014	0.099***	0.040	0.034
	(0.033)	(0.026)	(0.027)	(0.029)	(0.029)	(0.027)
Imam × Scientific × [...]	−0.081***	−0.000	−0.010	0.101***	0.085***	0.021
	(0.031)	(0.027)	(0.027)	(0.029)	(0.029)	(0.027)
Scientist × Scientific × [...]	−0.136***	−0.067**	0.028	0.110***	0.071**	0.065**
	(0.035)	(0.027)	(0.027)	(0.028)	(0.028)	(0.027)
Scientist × Religious × [...]	−0.074**	−0.027	−0.005	0.121***	0.051*	0.021
	(0.033)	(0.026)	(0.027)	(0.028)	(0.028)	(0.026)
Panel C: Willingness to take action						
Imam × Religious × [...]	0.244*	0.031	0.015	0.161	−0.051	0.190*
	(0.128)	(0.102)	(0.107)	(0.114)	(0.111)	(0.106)
Imam × Scientific × [...]	0.223*	0.089	0.106	0.104	0.084	0.057
	(0.125)	(0.100)	(0.104)	(0.114)	(0.112)	(0.103)
Scientist × Scientific × [...]	0.119	−0.056	0.063	0.247**	0.100	0.117
	(0.133)	(0.102)	(0.107)	(0.109)	(0.107)	(0.106)
Scientist × Religious × [...]	0.110	0.130	−0.065	0.180*	−0.075	0.053
	(0.125)	(0.098)	(0.104)	(0.108)	(0.108)	(0.103)
N	3,002	3,002	3,002	3,002	3,002	3,002

Notes: This table reports heterogeneous effects by high (above median) initial knowledge on land subsidence in Jakarta, high trust (above median) on various entities, high experience (above median) with environmental issues (e.g., flooding, hot weather), indicators for having bottled water as main source for drinking, being Islam and female, respectively. Each panel reports separate sets of regressions with different dependent variable. All regressions include control variables such as age group, female, education level, employed, main drinking water: bottled water, installed PDAM, religion, income level, household size, residence and home ownership. Standard errors are robust to heteroskedasticity. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

ONLINE APPENDIX

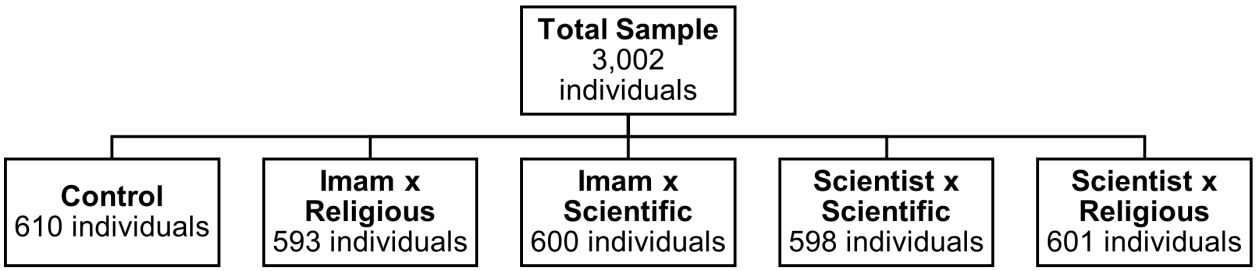
A Additional Figures and Tables

Figure A.1: Land subsidence rate in 2022



Note: This figure depicts land subsidence rate in Jakarta in 2022. Source: Authors' analyses derived from Open Data Jakarta.

Figure A.2: Study Design



Note: The figure shows the design of the experiment. Total sample size is 3,002 individuals distributed into five groups: Treatment 1 (Imam × Religious), Treatment 2 (Imam × Scientific), Treatment 3 (Scientist × Scientific), Treatment 4 (Scientist × Religious), and Control. Participants in Treatment 1 watched an environmental message delivered by an Imam using a religious narrative, while those in Treatment 2 watched an Imam presenting the message with a scientific narrative. Participants in Treatment 3 watched a scientist presenting an environmental message using a scientific narrative, while those in Treatment 4 watched a scientist presenting the message with a religious narrative.

Table A.1: Index Components of Trust in Capacities to Address Land Subsidence Issue

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Trust index	Trust themselves	Trust others	Trust businesses	Trust government	Trust imams	Trust scientists
Panel A							
Imam × Religious	0.162***	0.044***	0.021	0.011	0.050***	0.038**	0.031**
	(0.053)	(0.015)	(0.014)	(0.016)	(0.017)	(0.015)	(0.014)
		[0.017]	[0.101]	[0.250]	[0.017]	[0.032]	[0.036]
Imam × Scientific	0.130**	0.034**	0.017	−0.005	0.033**	0.045***	0.037***
	(0.054)	(0.015)	(0.014)	(0.017)	(0.017)	(0.016)	(0.014)
		[0.036]	[0.172]	[0.384]	[0.051]	[0.018]	[0.026]
Scientist × Scientific	0.145***	0.058***	0.021	0.000	0.039**	0.004	0.036**
	(0.054)	(0.015)	(0.014)	(0.017)	(0.017)	(0.016)	(0.014)
		[0.001]	[0.101]	[0.469]	[0.036]	[0.385]	[0.028]
Scientist × Religious	0.116**	0.056***	0.013	−0.019	0.027	0.014	0.032**
	(0.053)	(0.015)	(0.014)	(0.017)	(0.017)	(0.016)	(0.014)
		[0.001]	[0.236]	[0.181]	[0.100]	[0.238]	[0.036]
Panel B							
Imam × (Religious - Scientific)	0.032	0.010	0.005	0.017	0.017	−0.007	−0.005
	(0.053)	(0.015)	(0.014)	(0.017)	(0.017)	(0.016)	(0.014)
Religious × (Imam - Scientist)	0.045	−0.012	0.008	0.031*	0.023	0.024	−0.001
	(0.052)	(0.015)	(0.014)	(0.017)	(0.017)	(0.016)	(0.014)
Scientific × (Imam - Scientist)	−0.015	−0.023	−0.004	−0.005	−0.006	0.041***	0.001
	(0.054)	(0.015)	(0.014)	(0.017)	(0.017)	(0.016)	(0.014)
Scientist × (Religious - Scientific)	−0.028	−0.002	−0.007	−0.020	−0.012	0.010	−0.004
	(0.053)	(0.015)	(0.014)	(0.017)	(0.017)	(0.016)	(0.014)
(Imam - Scientist) × (Religious - Scientific)	0.060	0.012	0.012	0.036	0.029	−0.017	−0.002
	(0.075)	(0.021)	(0.020)	(0.024)	(0.024)	(0.022)	(0.020)
N	3,002	3,002	3,002	3,002	3,002	3,002	3,002
R^2	0.175	0.187	0.083	0.066	0.069	0.114	0.181
Control mean	0.000	0.586	0.490	0.450	0.491	0.529	0.681
Test of equality (p-value)							
Imam × Religious = Imam × Scientific	0.545	0.481	0.744	0.324	0.300	0.640	0.701
Scientist × Religious = Scientist × Scientific	0.594	0.917	0.605	0.259	0.487	0.530	0.790

Notes: Dependent variable in Column 1 is an index variable that is standardized with control as the reference group. Columns 2-7 present the components of the index variable in Column 1—measured using a Likert scale and normalized to have responses between 0 and 1. All regressions include control variables such as age group, female, education level, employed, main drinking water: bottled water, installed PDAM, religion, income level, household size, residence and home ownership. Standard errors are robust to heteroskedasticity. Anderson's Sharpened q-value in square brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.2: Index Components of Willingness to Take Concrete Actions

	(1)	(2)	(3)	(4)	(5)	(6)
	Action index	Water consumption reduction	Spreading info on harmful groundwater extraction impact	Vote for governor addressing land subsidence	Install PDAM	Relocate for access to PDAM
Panel A						
Imam × Religious	0.119**	0.047***	0.012	0.013	0.017	0.033*
	(0.053)	(0.017)	(0.014)	(0.015)	(0.015)	(0.018)
		[0.018]	[0.192]	[0.181]	[0.144]	[0.051]
Imam × Scientific	0.161***	0.037**	0.031**	0.008	0.036**	0.053***
	(0.051)	(0.017)	(0.014)	(0.015)	(0.015)	(0.018)
		[0.036]	[0.036]	[0.254]	[0.029]	[0.018]
Scientist × Scientific	0.173***	0.046***	0.016	0.012	0.035**	0.067***
	(0.053)	(0.017)	(0.015)	(0.015)	(0.016)	(0.018)
		[0.018]	[0.144]	[0.193]	[0.036]	[0.001]
Scientist × Religious	0.210***	0.072***	0.052***	0.016	0.038**	0.040**
	(0.051)	(0.017)	(0.014)	(0.015)	(0.015)	(0.018)
		[0.001]	[0.001]	[0.144]	[0.025]	[0.036]
Panel B						
Imam × (Religious - Scientific)	−0.043	0.010	−0.019	0.005	−0.019	−0.020
	(0.052)	(0.017)	(0.014)	(0.015)	(0.014)	(0.018)
Religious × (Imam - Scientist)	−0.091*	−0.025	−0.040***	−0.003	−0.022	−0.007
	(0.051)	(0.017)	(0.014)	(0.014)	(0.015)	(0.018)
Scientific × (Imam - Scientist)	−0.011	−0.009	0.015	−0.004	0.001	−0.014
	(0.052)	(0.016)	(0.015)	(0.015)	(0.015)	(0.018)
Scientist × (Religious - Scientific)	0.037	0.026	0.036**	0.004	0.003	−0.027
	(0.052)	(0.016)	(0.015)	(0.015)	(0.015)	(0.018)
(Imam - Scientist) × (Religious - Scientific)	−0.080	−0.016	−0.055***	0.000	−0.022	0.007
	(0.073)	(0.023)	(0.021)	(0.021)	(0.021)	(0.026)
N	3,002	3,002	3,002	3,002	2,649	2,649
R^2	0.213	0.097	0.180	0.112	0.150	0.103
Control mean	0.000	0.537	0.681	0.720	0.736	0.602
Test of equality (p-value)						
Imam × Religious = Imam × Scientific	0.409	0.561	0.173	0.748	0.175	0.272
Scientist × Religious = Scientist × Scientific	0.474	0.109	0.016	0.775	0.828	0.136

Notes: Dependent variable in Column 1 is an index variable that is standardized with control as the reference group. Columns 2-6 present the components of the index variable in Column 1—measured using a Likert scale and normalized to have responses between 0 and 1. All regressions include control variables such as age group, female, education level, employed, main drinking water: bottled water, installed PDAM, religion, income level, household size, residence and home ownership. Standard errors are robust to heteroskedasticity. Anderson's Sharpened q-value in square brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.3: Index Components of Support for Policies to Address Land Subsidence Issue (1)

	(1)	(2)	(3)	(4)	(5)	(6)
	Policy support index	Tax groundwater extraction	Restrict households groundwater use	Restrict business groundwater use	Reduce PDAM tariff	Mandate infiltration wells
Panel A						
Imam × Religious	0.066	0.041**	0.014	0.012	0.009	−0.020
	(0.050)	(0.016)	(0.015)	(0.014)	(0.013)	(0.014)
		[0.172]	[0.748]	[0.789]	[0.797]	[0.599]
Imam × Scientific	0.088*	0.040**	0.039***	0.011	0.017	−0.008
	(0.049)	(0.016)	(0.014)	(0.014)	(0.013)	(0.014)
		[0.172]	[0.172]	[0.789]	[0.629]	[0.924]
Scientist × Scientific	0.077	0.044***	0.020	0.013	0.013	−0.002
	(0.051)	(0.017)	(0.015)	(0.014)	(0.013)	(0.014)
		[0.172]	[0.629]	[0.789]	[0.748]	[0.992]
Scientist × Religious	0.111**	0.039**	0.032**	0.023*	0.010	0.005
	(0.050)	(0.017)	(0.014)	(0.014)	(0.013)	(0.014)
		[0.172]	[0.172]	[0.443]	[0.789]	[0.992]
Panel B						
Imam × (Religious - Scientific)	−0.021	0.001	−0.025*	0.002	−0.008	−0.012
	(0.048)	(0.016)	(0.014)	(0.014)	(0.013)	(0.014)
Religious × (Imam - Scientist)	−0.044	0.002	−0.017	−0.011	−0.001	−0.025*
	(0.050)	(0.016)	(0.015)	(0.014)	(0.013)	(0.014)
Scientific × (Imam - Scientist)	0.011	−0.004	0.019	−0.003	0.004	−0.006
	(0.049)	(0.016)	(0.015)	(0.014)	(0.013)	(0.014)
Scientist × (Religious - Scientific)	0.034	−0.005	0.012	0.010	−0.003	0.007
	(0.050)	(0.017)	(0.015)	(0.014)	(0.013)	(0.014)
(Imam - Scientist) × (Religious - Scientific)	−0.055	0.006	−0.036*	−0.008	−0.005	−0.019
	(0.070)	(0.023)	(0.021)	(0.020)	(0.019)	(0.019)
N	3,002	3,002	3,002	3,002	3,002	3,002
R^2	0.311	0.130	0.171	0.206	0.224	0.223
Control mean	0.000	0.620	0.703	0.773	0.786	0.745
Test of equality (p-value)						
Imam × Religious = Imam × Scientific	0.656	0.940	0.081	0.893	0.566	0.365
Scientist × Religious = Scientist × Scientific	0.503	0.760	0.438	0.494	0.843	0.618

Notes: Dependent variable in Column 1 is an index variable that is standardized with control as the reference group. Columns 2-6 present the components of the index variable in Column 1—measured using a Likert scale and normalized to have responses between 0 and 1. All regressions include control variables such as age group, female, education level, employed, main drinking water: bottled water, installed PDAM, religion, income level, household size, residence and home ownership. Standard errors are robust to heteroskedasticity. Anderson's Sharpened q-value in square brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.4: Index Components of Support for Policies to Address Land Subsidence Issue (2)

	(1)	(2)	(3)	(4)	(5)
	Expand PDAM coverage area	Educate community	Subsidize new PDAM installation	Build sea walls and flood controls	No pushing Jakarta econ growth
Panel A					
Imam × Religious	0.013	0.011	0.010	−0.017	0.019
	(0.013)	(0.013)	(0.013)	(0.014)	(0.015)
	[0.748]	[0.789]	[0.797]	[0.629]	[0.629]
Imam × Scientific	0.016	0.006	0.025*	−0.014	0.018
	(0.013)	(0.013)	(0.013)	(0.014)	(0.015)
	[0.629]	[0.949]	[0.313]	[0.748]	[0.656]
Scientist × Scientific	−0.002	0.002	0.020	−0.012	0.011
	(0.014)	(0.014)	(0.014)	(0.014)	(0.016)
	[0.992]	[1.000]	[0.599]	[0.789]	[0.810]
Scientist × Religious	0.011	0.030**	0.026*	−0.004	0.024
	(0.013)	(0.013)	(0.013)	(0.014)	(0.015)
	[0.789]	[0.172]	[0.280]	[0.992]	[0.531]
Panel B					
Imam × (Religious - Scientific)	−0.002	0.005	−0.015	−0.003	0.001
	(0.012)	(0.012)	(0.013)	(0.014)	(0.015)
Religious × (Imam - Scientist)	0.003	−0.019	−0.016	−0.012	−0.005
	(0.013)	(0.013)	(0.013)	(0.014)	(0.015)
Scientific × (Imam - Scientist)	0.018	0.005	0.005	−0.002	0.007
	(0.013)	(0.013)	(0.014)	(0.014)	(0.016)
Scientist × (Religious - Scientific)	0.013	0.028**	0.006	0.007	0.013
	(0.014)	(0.014)	(0.014)	(0.014)	(0.015)
(Imam - Scientist) × (Religious - Scientific)	−0.015	−0.023	−0.021	−0.010	−0.012
	(0.018)	(0.018)	(0.019)	(0.020)	(0.021)
N	3,002	3,002	3,002	3,002	3,002
R^2	0.266	0.216	0.203	0.200	0.138
Control mean	0.803	0.792	0.767	0.773	0.673
Test of equality (p-value)					
Imam × Religious = Imam × Scientific	0.865	0.703	0.252	0.840	0.953
Scientist × Religious = Scientist × Scientific	0.351	0.040	0.655	0.597	0.404

Notes: Columns 1-5 present the components of the index variable in Table A.4. in Column 1—measured using a Likert scale and normalized to have responses between 0 and 1. All regressions include control variables such as age group, female, education level, employed, main drinking water: bottled water, installed PDAM, religion, income level, household size, residence and home ownership. Standard errors are robust to heteroskedasticity. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Anderson's Sharpened q-value in square brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.5: Index Components of Perception of Environmental Threats and Solutions

	(1)	(2)	(3)	(4)
	Perception index	Perception of environmental issues as divine intervention	Perception of scientific explanations for environmental events	Perception of optimism in land subsidence prevention
Panel A				
Imam × Religious	−0.022	−0.004	−0.001	−0.005
	(0.056)	(0.016)	(0.012)	(0.014)
		[1.000]	[1.000]	[1.000]
Imam × Scientific	0.013	−0.012	0.013	0.008
	(0.055)	(0.016)	(0.012)	(0.014)
		[1.000]	[1.000]	[1.000]
Scientist × Scientific	0.032	−0.011	0.010	0.019
	(0.056)	(0.016)	(0.012)	(0.014)
		[1.000]	[1.000]	[1.000]
Scientist × Religious	0.029	−0.019	0.020*	0.019
	(0.055)	(0.016)	(0.012)	(0.014)
		[1.000]	[1.000]	[1.000]
Panel B				
Imam × (Religious - Scientific)	−0.035	0.008	−0.014	−0.014
	(0.055)	(0.016)	(0.012)	(0.014)
Religious × (Imam - Scientist)	−0.051	0.016	−0.021*	−0.024*
	(0.054)	(0.016)	(0.012)	(0.014)
Scientific × (Imam - Scientist)	−0.019	−0.001	0.003	−0.011
	(0.055)	(0.016)	(0.012)	(0.014)
Scientist × (Religious - Scientific)	−0.003	−0.008	0.010	−0.001
	(0.054)	(0.016)	(0.012)	(0.014)
(Imam - Scientist) × (Religious - Scientific)	−0.032	0.016	−0.024	−0.013
	(0.077)	(0.023)	(0.017)	(0.020)
N	3,002	3,002	3,002	3,002
R^2	0.067	0.136	0.234	0.173
Control mean	0.000	0.283	0.796	0.739
Test of equality (p-value)				
Imam × Religious = Imam × Scientific	0.521	0.624	0.245	0.325
Scientist × Religious = Scientist × Scientific	0.950	0.604	0.412	0.962

Notes: Dependent variable in Column 1 is an index variable that is standardized with control as the reference group. Columns 2-4 present the components of the index variable in Column 1—measured using a Likert scale and normalized to have responses between 0 and 1. All regressions include control variables such as age group, female, education level, employed, main drinking water: bottled water, installed PDAM, religion, income level, household size, residence and home ownership. Standard errors are robust to heteroskedasticity. Anderson's Sharpened q-value in square brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

B Intervention Scripts

The actor read the script for each message and narrative in the Indonesian language. The script is translated into English as follows:

Environmental message *Jakarta is facing a severe issue of land subsidence, where the ground surface is dropping below sea level. Jakarta is the fastest-sinking city in the world. Half of Jakarta's land is already underwater and could sink by another 1 to 15 centimeters every year. This is very concerning because if this continues to happen, by 2050, a quarter of Jakarta could be completely sunk. One clear example is the Wal Adhuna Mosque in North Jakarta; half of it is now underwater. In the last 10 years, North Jakarta has already sunk by 2.5 meters. A small increase in rainfall could immediately lead to floods. This adversely affects the economy and disturbs people's daily activities. Climate change causes an increase in sea level, but do you know the most significant factor causing land subsidence in Jakarta? Excessive soil drilling and groundwater extraction. People in Jakarta are heavily dependent on groundwater for daily needs in residential areas, office buildings, hotels and shopping malls. On average, groundwater contributes 60% to Jakarta's total annual water consumption level. I understand that not all of us have access to cheap and safe PDAM (regional drinking water companies), but we cannot continue using groundwater that is harming the environment. Our government has taken some steps to reduce our dependence on groundwater by improving access to PDAM, providing subsidies and imposing limits on groundwater use.*

Religious narrative *God, may He be praised and exalted, said in Surah Al-A'raf verse 56: "Do not spread corruption in the land after it has been set in order. And call upon Him with hope and fear. Indeed, Allah's mercy is always close to the good-doers." As believers, we are responsible for caring for the Earth that God has given us. Fellow believers have started by working together with the Ministry of Environment and Forestry to spread messages on preserving nature and the environment. I hope that what I talked about today could enlighten all of us about the threat of sinking Jakarta. If God wills, we can save Jakarta together. May God give us success and guidance. Peace be upon you, and mercy and blessings of God.*

Scientific narrative *In a well-known scientific journal, a team of scientists from around the world reported that Indonesia has one of the highest population densities in areas prone to land subsidence. This poses a serious threat to people living in Jakarta. According to the Professor of Meteorology in BRIN (National Research and Innovation Agency), some parts of Jakarta are especially vulnerable to land subsidence because they were originally swamps that have been drained. Coastal flooding could reach 1 meter per second if land subsidence continues at the current rate. Therefore, we must immediately seek preventive measures. I hope what I discussed today could increase our awareness of the threat of sinking Jakarta. We can save Jakarta together.*

C Variable Description

Table C.1: Variable description

Variable	Description
Aged 18-23	Indicator variable for respondents aged between 18 and 23 years old.
Aged 24-39	Indicator variable for respondents aged between 24 and 39 years old.
Aged 40-54	Indicator variable for respondents aged between 40 and 54 years old.
Aged 55+	Indicator variable for respondents aged 55 and older.
Female	Indicator variable for female.
Edu: Elementary or lower	Indicator variable for having completed elementary education or lower.
Edu: High school	Indicator variable for having completed high school or secondary education.
Edu: University	Indicator variable for having completed vocational, bachelor's degree or higher.
Employed	Indicator variable for being employed.
Main drinking water: bottled water	Indicator variable for having bottled water as main drinking water.
Installed PDAM	Indicator variable for respondents who installed PDAM in their premise.
Islam	Indicator variable for having Islam as religion.
Christian Catholic	Indicator variable for having Christian Catholic as religion.
Christian Protestant	Indicator variable for having Christian Protestant as religion.
Other religion	Indicator variable for having other religion.
Income: $<$ IDR 5 mil.	Indicator variable for having income less than IDR 5 millions.
Income: IDR 5-9.99 mil.	Indicator variable for having income between IDR 5 and 9.99 millions.
Income: $>$ IDR 10 mil.	Indicator variable for having income more than IDR 10 millions.

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Table C.1: Variable description (Continued)

HH size: small(1-2)	Indicator variable for respondent's household member numbers are between 1 and 2.
HH size: medium(3-4)	Indicator variable for respondent's household member numbers are between 3 and 4.
HH size: big(5+)	Indicator variable for respondent's household member numbers are 5 or more.
Bekasi, regency	Indicator variable for respondents who lived in Bekasi regency.
Bekasi, city	Indicator variable for respondents who lived in Bekasi city.
Bogor, regency	Indicator variable for respondents who lived in Bekasi regency.
Bogor, city	Indicator variable for respondents who lived in Bogor regency.
Depok, city	Indicator variable for respondents who lived in Bogor city.
West Jakarta	Indicator variable for respondents who lived in West Jakarta.
Central Jakarta	Indicator variable for respondents who lived in Central Jakarta.
South Jakarta	Indicator variable for respondents who lived in South Jakarta.
East Jakarta	Indicator variable for respondents who lived in East Jakarta.
North Jakarta	Indicator variable for respondents who lived in North Jakarta.
Tangerang, regency	Indicator variable for respondents who lived in Tangerang regency.
Tangerang, city	Indicator variable for respondents who lived in Tangerang city.
South Tangerang, city	Indicator variable for respondents who lived in South Tangerang city.
Own current house	Indicator variable for owning current house.
Outcome	
Primary	
Belief on land subsidence	Indicator variable for whether respondent believe that land subsidence would submerged Jakarta.

Continued on next page

Table C.1: Variable description (Continued)

Belief on harmful groundwater extraction impact	Re-scaled variable (between 0 and 1) from a Likert scale variable where 0 refers to weak belief of impact on groundwater extraction and 4 otherwise.
Trust index	Index variable constructed from responses to questions regarding trust themselves, others, businesses, government, imams, and scientists. These questions are elicited on a 5-point Likert scale, where 0 refers to not confident at all and 4 refers to completely confident. This index is standardized with control as reference group.
Action index	Index variable constructed from responses to questions regarding likelihood of water consumption reduction, spreading info on harmful groundwater extraction impact, vote for governor addresing land subsidence, install PDAM, and relocate for access to PDAM. These questions are elicited on a 5-point Likert scale, where 0 refers to extremely unlikely and 4 refers to extremely likely. This index is standardized with control as reference group.
Policy support index	Index variable constructed from responses to questions regarding favoring of some policy scenarios such as tax groundwater extraction, restrict households and businesses groundwater use, reduce PDAM tariff, mandate infiltration wells, expand PDAM coverage, educate community, subsidize new PDAM installation, build sea walls and flood controls, and restrict Jakarta economic growth. These questions are elicited on a 5-point Likert scale, where 0 refers to strongly oppose and 4 refers to strongly support. This index is standardized with control as reference group.

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Table C.1: Variable description (Continued)

Perception index	Index variable constructed from responses to questions regarding perception on environmental issues as divine intervention, scientific explanations for environmental events, and optimism in land subsidence prevention. These questions are elicited on a 5-point Likert scale, where 0 refers to strongly disagree and 4 refers to strongly agree. This index is standardized with control as reference group.
Robustness	
Social desirability bias score	Variable constructed from various socially desirable answers such as hard to continue work without incentive, feel dissapointed when do not get what they want, given up on something due to underestimated their abilities, felt rebelling against authority even though they were right, always a good listener, take advantage of someone, willing to admit mistakes, retaliate rather than forgive and forget, always polite, never get upset when someone express different ideas, put too much pressure on others, pretending to be sick, and get annoyed by people asking for favors.
Heterogeneous	
High knowledge	Re-scaled variable (between 0 and 1) from a Likert scale variable where 0 refers to not at all knowledgeable and 4 otherwise. This variable is constructed as binary where 0 refers to below median and 1 refers to above median.

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Table C.1: Variable description (Continued)

High trust	Index variable that constructed from responses to questions regarding trustworthy of corporate sectors, municipal and government officials, imams, academic researchers, healthcare workers, and regional and national legislators. These questions are elicited on a 4-point Likert scale, where 0 refers to not trustworthy at all and 3 refers to completely trustworthy. This index variable is standardized with control as reference group then constructed as binary where 0 refers to below median and 1 refers to above median.
High experience with environmental issues	Index variable that constructed from responses to questions regarding experience with environmental issues such as flooding, water shortage, poor air quality, sea-level rise, hot weather/heatwaves, and windstorm. This index variable is standardized with control as reference group then constructed as binary where 0 refers to below median and 1 refers to above median.
Bottled water for drinking	Binary variable whether having bottled water as main drinking water.
Islam	Binary variable whether having Islam as religion.
Female	Binary variable whether the respondents are female.