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

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Abstract

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, increasing participants' perceptions of the messenger as persuasive and trustworthy. 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.

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

JEL Classification: Q54, Q58, Z12

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1 Introduction

Despite overwhelming 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]

Low-cost, targeted information campaigns can be an effective way for policymakers to promote challenging policies. Studies show that endorsement from influential figures can increase vaccination rates (Banerjee et al., 2020; Alatas et al., 2024), while providing information on input quantities (Jessoe and Rapson, 2014), social comparison (Allcott, 2011; Allcott and Rogers, 2014), and moral suasion messages (Ito et al., 2018) can promote energy conservation.

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). This approach may be particularly effective in developing countries, where local cultural and religious values strongly shape behaviors (Bénabou and Tirole, 2016; Nunn, 2019).[2] Exposure to scientific information and values has also been shown to increase public support for climate action (e.g., Bruine de Bruin and Bostrom, 2013; Motta, 2018). However, the effectiveness of information campaigns and moral appeals from religious and scientific communities is not well understood.

In this paper, we investigate how messenger identities and narrative styles influence the effectiveness of environmental messages. We ask two questions: (i) do messengers' identities matter more than the narrative style? (ii) can the interaction between messenger identity and message

[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] 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).

content generate larger gains? These questions are motivated by recent findings that the identity of the messenger and its interaction with message content have significant impacts on audience's responses (Afrouzi et al., 2024; Alsan and Eichmeyer, 2024). While addressing these questions is crucial for understanding belief formation and designing effective communication policies (Haaland et al., 2023), 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).[3]

To untangle these intricacies and empirically answer our questions, we conducted an online experiment with 3,002 participants in the Jakarta metropolitan area between July and August 2023. The experiment, carried out in collaboration with Qualtrics, varies the identity of the information source and the narrative style of the environmental message, aiming to assess their relative effectiveness in influencing awareness and attitudes on land subsidence, the gradual sinking of the Earth's surface, a pressing climate change issue caused by excessive groundwater consumption exacerbated by population growth, rapid urbanization, and more frequent droughts (Famiglietti, 2014; McDonald et al., 2014).[4] 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,[5] is a dire example, with some parts predicted to be completely underwater by 2050, potentially devastating its 31 million people and US$ 200 billion economy.[6] Although studies show that further subsidence can be mitigated through policies and actions that reduce groundwater stress (Herrera-García et al., 2021), many Jakarta residents remain largely unaware of the situation (Takagi et al., 2021).

We randomly exposed participants to an environmental video message embedded with differ-

[3] 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.

[4] 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).

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

[6] 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).

ent narratives (religious and scientific) delivered by different presenters (a single actor portrays both an Imam, a Muslim religious leader, and a scientist), resulting in a 2×2 research design and a control group (placebo message).[7] 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.[8]

We report three main findings. First, we establish that the treatment increases the proportion of respondents who believe that Jakarta will be completely submerged due to land subsidence and that groundwater extraction is the main cause. 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 interesting insights. 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, suggesting that information interventions alone may not translate awareness into action.

Overall, our results highlight the importance of a low-cost, targeted information campaign by

[7]We asked the actor to portray an Imam because Indonesia is predominantly Muslim (more than 80% of Jakarta residents and 65% of our sample).

[8]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.

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).[9]

This study contributes to the broad literature on climate action and environmental communication as well as behavior change in several ways. First, it tests the effectiveness of cross-domain messaging in influencing environmental attitudes and behaviors in a real-life and high-stakes setting: land subsidence. We complement existing research on climate policy framing (e.g., Dechezleprêtre et al., 2022 and other studies cited in Drews and van den Bergh, 2016) and religious messaging for nature conservation Buccione (2023). Our findings suggest that cross-domain messaging can promote environmental behavior change, particularly in contexts with limited access to information (Spektor et al., 2023) and trust in scientists (Alvarez et al., 2023).

Second, the findings add to the evidence on the role of religion in driving behavioral change (Bénabou and Tirole, 2016; Bursztyn et al., 2019) and shed light on the potential benefits of incorporating religious narratives into climate and environmental communication. We also provide insights into effective strategies for promoting environmental behavior change in areas with limited resources and competing priorities, building on research on non-pecuniary approaches to energy and resource conservation (Allcott, 2011; Ferraro and Price, 2013; Allcott and Rogers, 2014; Jessoe and Rapson, 2014). These findings are particularly relevant for designing effective environmental communication strategies in developing countries facing pressing climate-related challenges.

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

2 Background

2.1 Land Subsidence in Jakarta

Jakarta is the world's fastest-sinking city, with certain areas projected to sink by 5 meters by 2050, exacerbated by 25 cm of sea level rise (Kulp and Strauss, 2019). The primary cause is the over-extraction of groundwater, the city's main water source (Asian Development Bank, 2016; Saputra et al., 2017; Bagheri-Gavkosh et al., 2021). Figure A.1 shows the rate of land subsidence across Jakarta, indicating that northern areas are most vulnerable to its impacts.

To address this issue, the government has implemented various measures, such as lowering piped water subscription fares, expanding polder systems and infiltration wells, as well as restricting groundwater extraction for large buildings (>5,000 square meters, or 8 stories) and households.[10] Despite efforts to promote piped water adoption, groundwater extraction remains prevalent (Taftazani et al., 2022).

While these policies indicate growing attention to land subsidence, efforts to enhance public understanding and awareness about it are surprisingly overlooked. For example, our sample reveals that while 78% of the control group believes land subsidence is a serious problem, only 66% attribute it to human agency via groundwater extraction.

2.2 Islam and the Environment

Islam plays an arguably significant role in shaping the environmental attitudes and behaviors in Indonesia (Sumaktoyo, 2021; Gade, 2015), a predominantly Muslim country (87% self identifying as Muslim). Local religious leaders have contributed to environmental debates through an Islamic lens (Wee, 2024), while prominent Islamic organizations have launched initiatives to promote environmental protection. For example, the Indonesian Council of Ulama (MUI) has issued a fatwa declaring environmental protection a religious duty, while a large Islamic organization Muhammadiyah has launched an initiative (the Eco Bhineka program) to promote environmental

[10] 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

protection across faiths.

These efforts draw upon a rich corpus in Islamic teachings, including the Quran (the holy book of Islam) and Hadith (sayings of Muhammad, the prophet of Islam), which emphasize the importance of environmental conservation and earth protection. The Quran contains at least 80 verses on this topic, and the Hadith echoes similar narratives. For example, believers are encouraged towards conservation: "and eat and drink, but be not excessive. Indeed, He likes not those who commit excess" (Quran, 7:31). The importance of planting trees is also emphasized: "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). Additionally, countless rulings by religious scholars across time and space have established environmental protection and conservation as religious acts for practicing Muslims.

Our approach is motivated by three key aspects of Indonesian society: its large Muslim population, the willingness of local Islamic leaders (Ulama) to engage with environmental issues, and the existence of a significant body of Islamic literature on environmental topics. 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 is residents of Jakarta and its surrounding areas (Bogor, Depok, Tangerang, and Bekasi, known as Bodetabek). We focus on Jakarta and Bodetabek due to the immediate and indirect impacts of land subsidence. Approximately 1.25 million people from Bodetabek commute to Jakarta daily, accounting for around 11% of Jakarta's population (Statistics Indonesia, 2019). We recruited participants from a Qualtrics panel, resulting in a nationally representative sample of 3,002 individuals aged 18+, with balanced gender representation and diverse education, income, and religious backgrounds.

Treatments. This study has three goals. First, to test the effectiveness of an informational video message on environmental awareness, attitude, and policy support. Second, to isolate the effects of narrative type (religious or scientific) and presenter identity (a Muslim religious leader (Imam) or climate change scientist—hereafter referred to as scientist). Third, to identify the most effective combination of presenter identity and narrative type.

To this end, we designed a 2×2 experiment with a control group (see Figure A.2). We cross randomize the presenter identity (Imam vs. scientist) and the narrative (religious vs. scientific) to create four treatment groups. The control group is exposed to a placebo video message. Each treatment group received a 3.5-minute video message, consisting of a 2.5-minute environmental message followed by a 1-minute narrative. The control group received a placebo message of similar duration.

- **Treatment 1 (Imam × Religious):** An Imam presents an environmental message with a religious narrative.
- **Treatment 2 (Imam × Scientific):** An Imam presents an environmental message with a scientific narrative.
- **Treatment 3 (Scientist × Scientific):** A scientist presents an environmental message with a scientific narrative.
- **Treatment 4 (Scientist × Religious):** A scientist presents an environmental message with a religious narrative.
- **Control:** Participants view a placebo video about Jakarta's general history without a presenter.

Intervention details. We hired an actor to appear both as an Imam and a scientist to present each video message. This ensures that subconscious individual-level body language, potentially independent of the actor's role, remains consistent across both treatments. We vary the presenter's identity by altering his appearance and greeting. The Imam wears a white shirt,

a short rounded skullcap (*taqiyah* or *kufi*) and a scarf and uses a common Islamic greeting (*Assalamualaikum warahmatullahi wabarakatuh* or *Peace be upon you, and mercy and blessings of God*). The scientist wears a casual shirt and glasses and uses a secular greeting, free from any religious attributes. To minimize potential biases, we omitted any references or affiliations from the video.[11] The actor delivers a scripted message, which was written in collaboration with a professional copywriter to ensure clarity and effectiveness.[12]

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.[13] 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 employs Islamic principles and scriptures to promote environmental awareness, highlighting the importance of joint efforts between Muslims and the government in nature preservation. On the other hand, the scientific narrative highlights findings from academic research on land subsidence consequences in Jakarta. These distinct framing strategies allow us to test their relative effectiveness in influencing environmental awareness, as suggested by Bain et al. (2012).

[11] All videos can be found here.

[12] The scripts for each message and narrative are shown in the Appendix B.

[13] 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).

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 self-reported 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), and environmental threat perception. Additionally, the survey collected data on socio-economic characteristics, climate change risk perception, drinking and non-drinking water sources, and groundwater usage.[14] To address the multiple hypothesis testing concerns, we constructed indices following Anderson (2008) for outcome variables comprising multiple related items, except for beliefs.[15] Detailed variable definitions can be found in Table C.1. To ensure data quality, Qualtrics automatically dropped participants that provided straightline answers, exhibited speedy or inconsistent response patterns.

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 most participants identifying as Muslim. Education levels vary, but more than 60% have either attended or graduated from university. Although 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. Following Imbens and Rubin (2015), we 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

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

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

was successful.[16]

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:

$$y_i = \beta_0 + \beta_1 \text{Imam}_i \times \text{Religious}_i + \beta_2 \text{Imam}_i \times \text{Scientific}_i + \beta_3 \text{Scientist}_i \times \text{Religious}_i + \beta_4 \text{Scientist}_i \times \text{Scientific}_i + \mathbf{X}_i' \gamma + \varepsilon_i \quad (1)$$

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

[16] 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.

our respondents' relatively low baseline familiarity with the issue—approximately 47 % reported being familiar with it.[17]

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* × (*Imam* - *Scientist*), given by $(\beta_1 - \beta_3)$. Similarly, the effect of the presenter identity when presenting *a scientific narrative* is *Scientific* × (*Imam* - *Scientist*), 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* × (*Religious* - *Scientific*), given by $(\beta_1 - \beta_2)$, while *Scientist* × (*Religious* - *Scientific*), given by $(\beta_3 - \beta_4)$, captures the differential impact when presented by *a scientist.* We also evaluate the difference-in-differences estimator (*Imam-Scientist*) × (*Religious-Scientific*) to isolate the effect of the presenter identity (Imam vs. scientist), independent of the narrative (religion vs. science).

Hypothesis. The 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.

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

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* × *Scientific*) and Treatment 4 (*Scientist* × *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.[18] This is possibly due to

[18]Table A.3 shows some support for imposing taxes on groundwater use but the result is not robust to the multiple

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 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.

hypothesis adjustment (sharpened q value > 0.1).

Social desirability bias. One concern in studies that measure stated preferences is whether responses accurately reflect true attitudes and behaviors (Epper et al., 2020; Tannenbaum et al., 2022). A credible method to verify this is by asking participants to invest time or money to express their views and measure their correlation with survey responses (Dechezleprêtre et al., 2022). Due to budget concerns, we could not implement this approach. Instead, we used Marlowe-Crowne scale (Crowne and Marlowe, 1960) to assess social desirability bias,[19] particularly for outcomes prone to this bias, such as trust, willingness to act, and support for mitigation policies (Dechezleprêtre et al., 2022). Table A.6 shows that high social desirability score (SDS) has no significant differential impacts on these outcomes, suggesting that while we cannot definitively verify if responses reflect real-world attitudes and behaviors, social desirability bias has minimal impact on our main findings.

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.[20] 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 %

[19] Participants in the treatment group, for instance, may have expressed more environmentally friendly views.
[20] For brevity, we do not include other secondary heterogeneity analyses.

of our participants reported having little knowledge about the issue.[21] 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

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

intervention.

6 Conclusion

This study experimentally studies the relative importance of the messenger identity and narrative style of an environmental video message in shaping environmental attitudes and behaviors in Jakarta, Indonesia, a city grappling with catastrophic consequences of land subsidence. 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 the scientist, plays a more significant role than the narrative style 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.

Third, our analysis documents heterogeneous treatment effects on individuals' beliefs and actions, underscoring the importance of tailoring communication approaches. Individuals with high initial knowledge are less receptive to updating their beliefs when the message comes from a scientist, while 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. The presenter identity is crucial in determining responses from specific religious groups. However, we find limited heterogeneous treatment responses on actions, suggesting that translating awareness into action may require additional measures beyond information interventions.

Our findings offer two important lessons for policies. First, a video message that conveys the urgency and consequences of environmental issues can be a powerful tool for influencing individuals' beliefs and behaviors. Second, the perceived expertise of the presenter may be more important than the alignment between the presenter identity and the narrative style. Policymakers should employ credible scientists and diverse narrative styles to effectively communicate environmental messages across various subgroups, particularly in countries with divided opinions

on environmental and climate issues.

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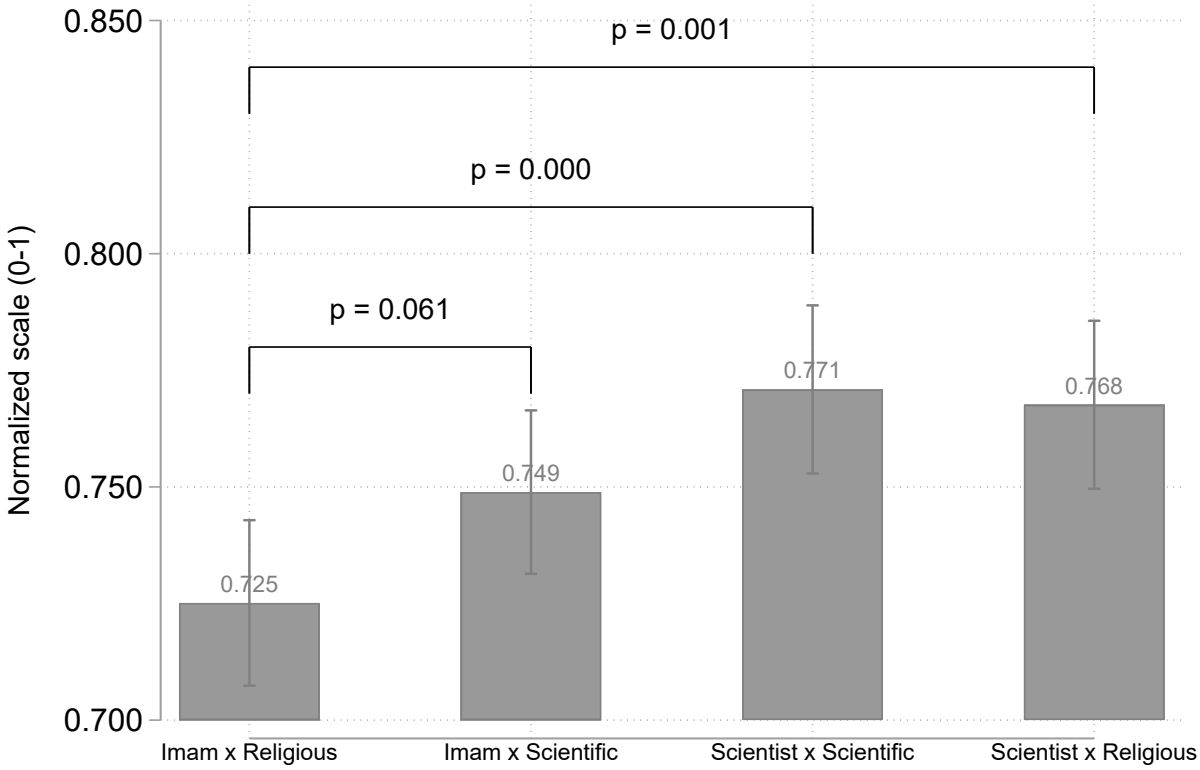
Main Figures and Tables

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

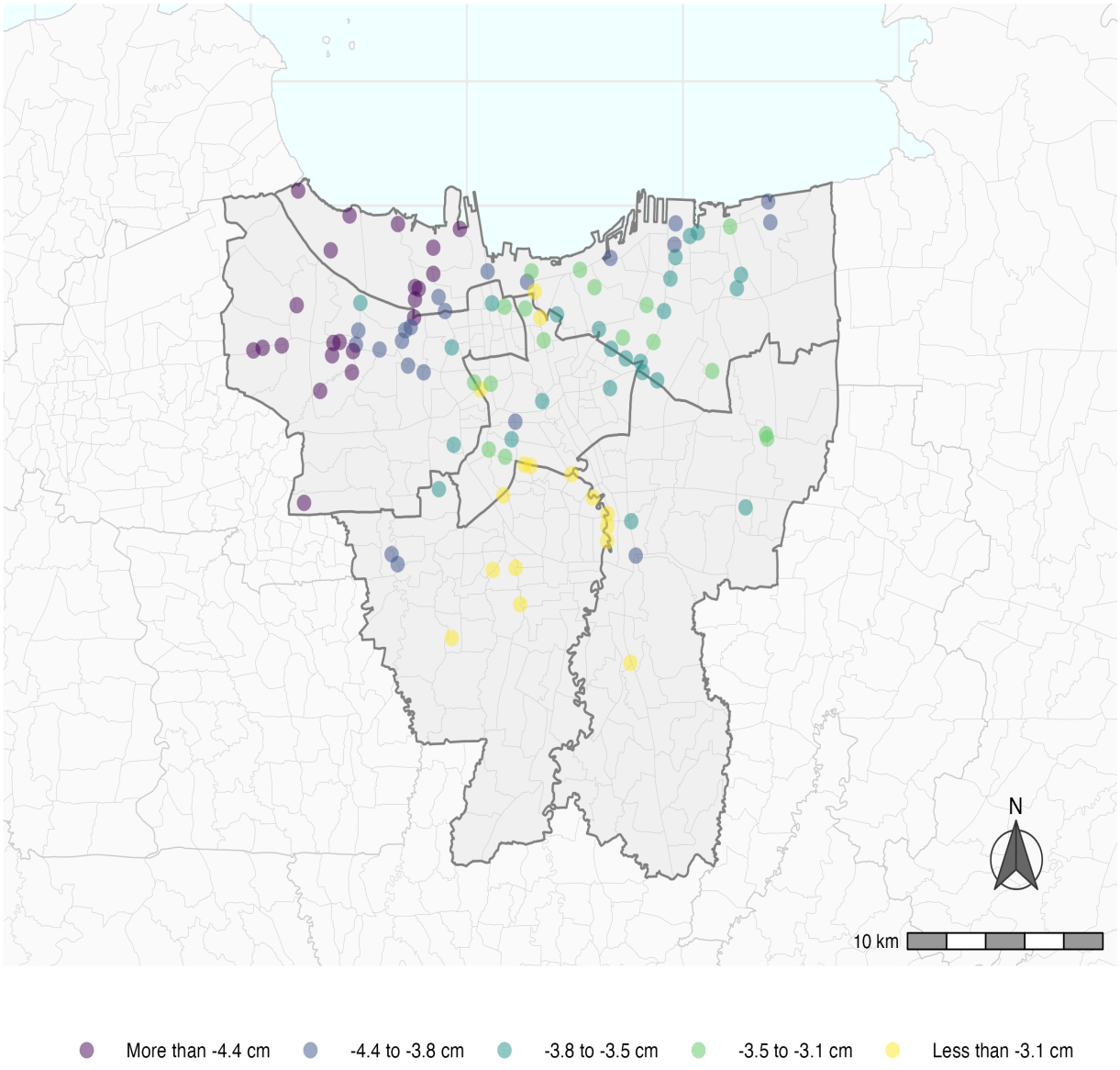
	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline [...]					
	High knowledge	High trust	High experience with environmental issues	Bottled water for drinking	Islam	Female
Panel A: Belief on existence of land subsidence						
Imam × Religious × [...]	−0.055	0.086**	0.026	0.082*	0.123**	0.086**
	(0.057)	(0.044)	(0.045)	(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

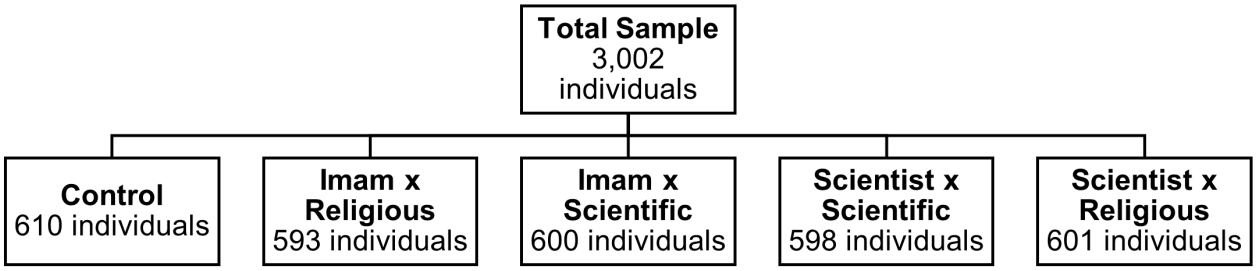
A Additional Figures and Tables

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. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.6: Social Desirability Bias

	(1)	(2)	(3)
	Trust index	Action index	Policy support index
Imam × Religious × High SDS	0.031	−0.031	0.012
	(0.105)	(0.104)	(0.100)
Imam × Scientific × High SDS	0.030	−0.167	−0.141
	(0.106)	(0.102)	(0.098)
Scientist × Scientific × High SDS	0.097	−0.024	0.030
	(0.107)	(0.105)	(0.102)
Scientist × Religious × High SDS	0.057	−0.030	−0.117
	(0.106)	(0.102)	(0.101)
N	3,002	3,002	3,002
R^2	0.184	0.224	0.322
Control mean	0.000	0.000	0.000
Test of equality (p-value)			
Imam × Religious × High SDS = Imam × Scientific × High SDS	0.998	0.187	0.116
Imam × Religious × High SDS = Scientist × Religious × High SDS	0.805	0.993	0.201
Imam × Scientific × High SDS = Scientist × Scientific × High SDS	0.536	0.166	0.081
Scientist × Religious × High SDS = Scientist × Scientific × High SDS	0.707	0.952	0.147

Notes: This table reports robustness check for social desirability bias. High SDS refers to having a social desirability score that is above median for the sample. Dependent variables in column 1-3 are index variables of trust on capacities to address land subsidence issue, willingness to take concrete actions, and support for mitigating policies, respectively—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 PDAM, religion, income level, household size, residence and home ownership. Standard errors are robust to heteroskedasticity. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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	

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Table C.1: Variable description (Continued)

Belief on land subsidence	Indicator variable for whether respondent believe that land subsidence would submerged Jakarta.
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.