Can a Religious Message Increase Forest Conservation? Evidence from Forest Users in Burundi

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August 6, 2026

Abstract

We study whether religious messaging can help address an environmental collective-action problem. We conduct a field experiment among forest users in rural Burundi, who are randomly assigned to hear a religious stewardship message, a secular civic-duty message, or a neutral message before deciding how much to contribute to forest conservation in a public-goods game. With 80% probability, the amount placed in the conservation account is donated to the public office responsible for forest protection. We find that the religious message increases contributions by 2.7 percentage points relative to the neutral message. This effect is statistically significant at the 5% level and corresponds to a 12.27% increase. The secular message has a smaller and statistically insignificant effect of 0.8 percentage points relative to the neutral message. The difference between the effects of the religious and secular messages is 1.8 percentage points, but is not statistically significant. We find no evidence that treatment effects vary with religiosity, religious affiliation, dependence on forest income, prior exposure to environmental messages in church, or pro-environmental perceptions. Our results suggest that religion can strengthen environmental cooperation by increasing individuals' willingness to bear private costs for conservation, even among those whose livelihoods depend directly on forest resources.[1]

JEL: H41 C93 D91 Q54 Q56 Z12

Keywords: Collective Action; Religion; Forest conservation; Public goods; Environmental behaviour; Field experiment; Natural resource management; Burundi

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[1]Our thanks to Eloi Sindayigaya, Jonas Niyonkuru, Lionel Mugisha, and the students of eduSpace at the University of Burundi for their excellent research assistance. We are also thankful to Michel Ndayikeza for his support. Ethical approval was provided by the Institut de Recherche en Statistique Appliquee (IRSA) at the Université Evangélique en Afrique (UEA/IRSA/047/2025). Data collection authorization was provided by the governors of Muramvya, Gitega, and Mwaro provinces. We grateful for their cooperation. AEA RCT Registry: AEARCTR-0016548.

1 Introduction

Environmental conservation often presents a collective-action problem: individuals bear the private costs of conserving natural resources, while many of the resulting benefits are shared with others (Stavins, 2011; Kosfeld and Rustagi, 2015). This tension is particularly acute where livelihoods depend directly on resource extraction, because conservation entails forgone income or consumption (Edmonds, 2002; Jayachandran, 2013). A central policy challenge is therefore to identify how private incentives can be aligned with the collective benefits of conservation (Ferraro and Price, 2013; Allcott and Rogers, 2014; Ito et al., 2018).

Religion may help address this challenge. Religion is a system of beliefs, norms, and institutions that shapes how individuals understand their obligations toward others and how they behave (Iyer, 2016; Henrich et al., 2019; Dunbar, 2022; Seabright, 2024). Research in economics and psychology shows that religion can promote fairness, generosity, and cooperation (Shariff et al., 2016; Purzycki et al., 2016). Its influence also extends to environmental attitudes and behaviour. Religious messages can strengthen climate-change beliefs and sustainable intentions (Schuldt et al., 2017; Shin and Preston, 2021; Eom et al., 2021), increase donations to climate-change mitigation (Feldhaus et al., 2022), and reduce the consumption or extraction of natural resources (Buccione, 2023; Sim et al., 2024).

The potential for religion to address environmental collective-action problems may be especially strong in developing countries. In many such settings, economic and population growth place increasing pressure on natural resources, large shares of the population depend directly on these resources for their livelihoods, and governments face difficulties monitoring extraction and enforcing environmental regulation (Angelsen et al., 2014; Burgess et al., 2012). At the same time, religion remains central to social and moral life (Pew Research Center, 2018). Few regions combine these conditions as strongly as Sub-Saharan Africa, one of the most religious regions in the world and home to forests and woodlands that are both globally important and central to rural livelihoods (Pew Forum on Religion & Public Life, 2010; Pew Research Center, 2018; IPBES, 2018; World Wildlife Fund, nd).[2]

In this paper, we test whether religious messaging can help address an environmental collective-action problem. We conduct a randomized field experiment with forest users in rural Burundi, where participants decide how much to contribute to forest conservation in a framed public-goods game. Before making this decision, participants are randomly assigned to hear a religious stewardship message taken from the Bible, a secular civic-duty message taken from Burundi's Forest Code, or a neutral message. With 80% probability, contributions to the conservation account are donated to the Burundian Office for the Environment (OBPE), the public agency responsible for forest protection.

We find that the religious message increases the share of the endowment contributed by 2.7 percentage points relative to the neutral message, an effect that is statistically significant at the 5% level. This is equivalent to a 12.27% increase in the amount contributed relative to the neutral message baseline. The secular message increases contributions by 0.8 percentage points relative to the neutral message, but this effect is not statistically significant. The estimated difference between the effects of the religious and secular messages is 1.8 percentage points, but it is not statistically significant. We find no evidence that treatment effects vary by religiosity, religious affiliation, dependence on forest income, prior exposure to environmental messages in church, or pro-environmental perceptions. Robustness checks using alternative functional forms, enumerator fixed effects, and randomization inference yield results consistent with the main findings. However, the estimated effect of the religious message is no longer statistically significant at the 10% level after adjusting for multiple hypothesis testing. In addition, a comparison of the neutral-message group with a separate no-message arm, implemented at a later date, provides no evidence that exposure to the neutral message independently affects contributions. Taken together, these results suggest that religious messaging can strengthen environmental cooperation even among people whose livelihoods depend directly on forest resources.

We posit that religion strengthens cooperation through a norm-satisfaction mechanism. The religious message makes stewardship toward nature more salient and activates a religious stewardship norm: the belief that humans have a moral duty to care for nature as part of God's creation. Participants may therefore interpret contributing to forest conservation as a way of satisfying this norm. This increases the moral payoff associated with contributing and, in turn, leads them to give more. The absence of heterogeneous treatment effects by religiosity or pro-environmental perceptions suggests that the stewardship norm is broadly shared in our setting, rather than being confined to particularly religious or environmentally concerned participants.

Burundi is a particularly suitable setting for this study. The country lost 47% of its forest cover between 1990 and 2005 (World Rainforests Information Portal, 2024). More recently, between 2002 and 2023, growing demand for charcoal and firewood, together with weak enforcement of environmental regulations, contributed to a 1.5% decline in primary forest area and a 6.6% decline in tree cover (Global Forest Watch, 2023). At the same time, religion occupies a central place in Burundian society: 96% of Burundians consider religion

[2] Across 34 African countries, nine in ten people identify with a religion and consider it very important, while three in ten report religious experiences such as divine healing or direct revelation (Katenda, 2022; Pew Forum on Religion & Public Life, 2010).

important or very important in their lives, and 90% report attending religious services weekly (Naso and Budurha, 2024; Zurlo, 2026; Afrobarometer, 2012, 2015). The influence of religious institutions and leaders extends beyond spiritual matters to community and public life (Longman, 1998; Naso and Swanson, 2024).

Our paper contributes to the literature on the economics of religion (Iannaccone, 1998; Iyer, 2016; Seabright, 2024; Benjamin et al., 2016; Auriol et al., 2020; Deopa and Rinaldo, 2023; Lowes et al., 2026). More specifically, it contributes to a still-emerging literature on the relationship between religion and the environment and on whether religion can promote conservation (Buccione, 2023; Al-Ubaydli et al., 2023; Sim et al., 2024; Feldhaus et al., 2022). We advance this literature in three ways. First, we examine religious messaging as a channel through which religion may affect conservation behaviour. We study this channel in a conservation-framed public-goods game with real transfers to support forest conservation. This design captures the collective-action nature of conservation, is incentive-compatible, and links participants' decisions to an actual conservation outcome. Second, our participants are forest users whose livelihoods depend on forest products and services. This provides a demanding test because conservation may conflict with their immediate economic interests. Finally, we study forest conservation in Sub-Saharan Africa. We extend previous evidence on water use, electricity consumption, and carbon-offset donations to a natural resource that is central to both rural livelihoods and environmental protection.

Our findings suggest that religion can help address environmental collective-action problems by increasing individuals' willingness to bear private costs for shared environmental benefits. This points to a potential role for religious messaging as a complement to formal environmental policy. Governments and environmental agencies could partner with churches and religious leaders to incorporate stewardship messages into reforestation campaigns and community forest-management activities, or integrate such messages into existing conservation programmes. Evidence that other brief conservation messages have generated behavioural responses of a similar magnitude supports the practical relevance of this approach (see Tonke (2024) and Brick et al. (2023)).

The paper is organized as follows. Section 2 reviews the literature on the relationship between religion and environmental behaviour. Section 3 provides background on Burundi's religious context and patterns of forest exploitation. Section 4 presents the experimental design: we describe the field experiment, present the sample and sampling strategy, explain the implementation procedures, and outline the testable hypotheses. Section 5 presents the empirical analysis, including the main results, heterogeneity analysis, and robustness checks. Section 6 discusses the potential mechanisms behind the main results and considers alternative explanations. Section 7 concludes.

2 Literature review

Our paper contributes to the literature on the economics of religion (Iannaccone, 1998; Iyer, 2016; Seabright, 2024; Lowes et al., 2026). This literature includes three well-established branches. The first investigates how religion affects prosociality and cooperation (Anderson and Mellor, 2009; Dhami et al., 2024; Akay et al., 2015; Gupta et al., 2018), and how these effects, in turn, shape economic behaviour (Benjamin et al., 2016; Auriol et al., 2020; Ahmad et al., 2023; Bentzen et al., 2026). The second examines how religion affects institutions (Mehmood and Seror, 2023; Rubin, 2017; Cantoni et al., 2018). The third studies how socioeconomic and environmental factors shape people's religious choices and behaviour (Bentzen, 2019; Aslam et al., 2022; Alfonsi et al., 2024).

Our work connects the first of these branches—the study of religion and cooperation—to an emerging literature on religion and the environment. Environmental conservation often requires individuals to bear private costs for benefits shared with others, yet little is known about whether religion can strengthen cooperation in such settings. More broadly, few studies in economics provide causal evidence on how religion shapes environmental perceptions and behaviour. We highlight four recent contributions to this literature.[3]

Buccione (2023) conducts an RCT in which Muslim women in Jordan assigned to both the treatment and control groups receive a secular message about water conservation. She finds that supplementing this message with Islamic teachings about the sacred characteristics of water increases donations to a water charity, both in absolute terms and relative to donations to other charities. Three months after the intervention, treated households have lower water consumption and water bills. Al-Ubaydli et al. (2023) conduct a field experiment with residential electricity customers in Qatar. They compare a religious message quoting the Qur'an with a national message emphasizing Qatar's commitment to energy conservation. Both messages reduce electricity use by 3.8%, with no significant difference between them.

Sim et al. (2024) conduct an online experiment in Indonesia in which participants receive a video message about land subsidence in Jakarta, including its causes, consequences, and connection to groundwater extraction. The authors exogenously vary both the narrative, religious or scientific, and the presenter, a religious leader

[3]Other studies examine associations between religion and environmental attitudes, behaviour, and natural-resource outcomes; see, for example, Zemo and Nigus (2021) and Cox et al. (2014). However, they do not provide experimental estimates of the effects of religion. A related contribution is Deopa and Rinaldo (2023), which combines theoretical and empirical analysis to examine how religious beliefs affect environmental outcomes in Benin.

or a scientist. Among their findings, they show that the largest positive effects arise when a scientist uses a religious narrative to convey the environmental message. Feldhaus et al. (2022) conduct a field experiment at the German Catholic Convention to examine the effects of Catholic institutions and religious identity on contributions to carbon-offset projects. Their treatment combines two primes: Pope Francis's encyclical on climate protection and a message from an environmental advisory board. They find that Catholic authority increases contributions to the climate-related donation, whereas religious identity and self-reported religiosity do not.

We advance this literature in three ways. First, we study religious messaging in a conservation-framed public-goods game that combines a collective-action decision with real transfers to forest conservation. Second, our participants are forest users whose livelihoods depend directly on forest products and services. This provides a particularly demanding test of religious messaging, since conservation conflicts with their immediate economic interests. Finally, we study forest conservation in Sub-Saharan Africa, extending previous evidence on water use, electricity consumption, and carbon-offset donations to a natural resource that is central to both rural livelihoods and environmental protection.

To make religion salient and generate exogenous variation, we use a message prime. A prime exposes participants to a short cue before they make a decision. The cue makes a particular idea or identity more salient without directly instructing participants how to behave. Both economists (Benjamin et al., 2016; Auriol et al., 2021; Naso, 2026) and psychologists (White et al., 2024; Shariff et al., 2016) use priming to study the effects of religious identity, beliefs and behaviour.

Recent research at the intersection of psychology and environmental studies examines how religion shapes environmental perceptions and beliefs. Shin and Preston (2021) expose participants in the United States to biblical stewardship passages and Pope Francis's environmental encyclical. They study effects on climate-change beliefs, moralization, and sustainable intentions. Schuldt et al. (2017) find that brief exposure to Pope Francis increases the perception of climate change as a moral issue, especially among Republicans, and strengthens personal responsibility among Democrats. Eom et al. (2021) show that a religious stewardship message increases environmental guilt, which in turn raises support for environmental projects.

These studies suggest that religious messages can affect environmental behaviour by activating moral norms and emotions. We focus on one such norm: religious stewardship, the belief that humans have a moral duty to care for nature as part of God's creation. We test whether making this norm salient changes conservation behaviour. We advance this literature by comparing a biblical stewardship message with a secular conservation message and a neutral message. This design allows us to assess whether the religious message produces a different response from both a secular conservation appeal and a neutral benchmark.

3 Context

We run our experiment in Burundi, a small, landlocked country with almost 12 million people (ISTEEBU, 2012). Burundi is among the poorest countries in the world, with GDP per capita of US$233.8 (World Bank, 2026). According to the World Bank, approximately 86% of the population lives in rural areas, where livelihoods are primarily based on subsistence agriculture.[4]

Religion in Burundi. Religion plays a central role in Burundi. Around 98.7% of Burundians identify as religious, 96% consider religion important or very important, and 90% report attending church services weekly (Naso and Budurha, 2024; Zurlo, 2026; Afrobarometer, 2012, 2015). The population is predominantly Christian: about 58.6% of Burundians are Catholic and 35.3% are Protestant, while Muslims (3.4%), members of other religions (1.3%), and those reporting no religion (1.3%) make up small minorities (Naso and Budurha, 2024).

The influence of religion extends beyond spiritual matters. Religious institutions and leaders play an important role in community life and politics in Burundi (Naso and Swanson, 2024). Religious leaders often hold privileged positions in their communities, possess more resources than state authorities, and maintain closer contact with the local population (Longman, 1998). The 2014 Afrobarometer, the most recent available for Burundi, illustrates this influence: religious leaders enjoy higher levels of trust and are perceived as less corrupt than most local authorities. For example, 81% of respondents say they trust religious leaders "very much," compared with 61% for the village chief. Similarly, 71% believe that religious leaders are not involved in corrupt practices, compared with 33% for the village chief.

Forest Exploitation. Forest resources have been under pressure in Burundi for decades. Between 1990 and 2005, the country lost approximately 47% of its forest cover, and forest area had fallen to only 7.6% of total land area by 2000 (World Rainforests Information Portal, 2024). More recently, between 2002 and 2023, Burundi's primary forest area declined by 1.5%, while tree cover declined by 6.6%, generating an estimated

[4]See https://data.worldbank.org/indicator/SP.URB.TOTL?locations=BI.

16.3 million metric tons of CO_2 emissions (Global Forest Watch, 2023). Forest loss has contributed to soil erosion and the degradation of habitats that are important for many plant and animal species.

The main driver of tree-cover loss in Burundi is the growing demand for charcoal and firewood (Megerle and Niragira, 2020; Bitama, 2023). In 2010, 95% of the population relied on wood as its primary source of cooking energy (Haider et al., 2016). Charcoal was used by 67.2% of urban households, while 86.3% of rural households relied on firewood (Ifegbesan and Makonese, 2022). Population growth and limited access to alternative energy sources are likely to place continued pressure on Burundi's forests.

Forest exploitation occurs in both planted forests and natural forests. Both are regulated under Burundian law. Tree cutting is restricted in protected areas, which contain much of Burundi's remaining natural forest, while exploitation of planted forests is also subject to management and replanting requirements when the harvested area exceeds a relatively low threshold (Budurha et al., 2025). In practice, however, weak enforcement means that illegal cutting and deforestation continue. Forest owners hire woodcutters and sell wood to firewood sellers, charcoal producers, and carpenters. Charcoal producers and sellers make up the largest group of workers in these value chains. Their earnings vary widely, from about US$20 to US$200 depending on the scale of the operation (Budurha et al., 2025). In rural Burundi, especially near regional and local markets, it is common to see large numbers of charcoal and firewood sellers supplying household energy needs.

4 Experimental Design

We outline the design of our experiment, including the sample and implementation procedures. We conclude by presenting our testable hypothesis.

4.1 The Experiment

Our experiment consists of a framed linear public-goods game in which participants receive a message prime before deciding the size of their contribution.

The Public-Goods Game. The game follows a standard linear public-goods game structure. Participant i decides how much of their initial endowment, E, to contribute to a public account, c_i, and how much to keep in a private account, p_i.

Participants are randomly matched into groups of four. The total group contribution is given by $S = c_1 + c_2 + c_3 + c_4$. The payoff of participant i is:

$$\pi_i = E - c_i + rS \tag{1}$$

where $r \in (0, 1)$ is the marginal per capita return from the public good. We set $r = 0.4$, which means that each participant has a private incentive to contribute nothing. However, the social return from one unit contributed is $4r = 1.6 > 1$, so the socially optimal outcome is for all participants to contribute their full endowment.

We frame the public good as forest conservation. Participants are told that any amount contributed supports forest conservation in Burundi, while any amount not contributed remains theirs. Participants face a 20% chance of receiving the public-good return, rS. With 80% probability, their contribution, c_i, is transferred directly to the Burundian Office for the Environment (OBPE), without the multiplier r. Participants are informed about these probabilities. We signed an agreement with OBPE, and all transferred funds were used for reforestation and afforestation projects.

Groups are formed randomly after participants decide how much to contribute. We then randomly draw the 20% of participants who receive the public-good return. On the day of the experiment, each participant keeps their initial endowment minus their contribution. Participants selected in the random draw receive the public-good return later by mobile money.

Before participants decide how much to contribute to forest conservation, they listen to a prime message.

Priming. Participants are randomly assigned to one of three groups: a religious prime, a secular prime, or a neutral prime. The message delivered to each group is as follows:

- T1 (Religious): *The Lord God took the man and put him in the Garden of Eden to work it and take care of it.*
- T2 (Secular): *The protection of forests and their development are ensured through rational and balanced management that contributes to the preservation of the environment.*
- T3 (Neutral): *In Burundi, people mostly speak Kirundi. French and English are also official languages.*

Our field team delivers all messages to participants in Kirundi, their mother tongue. After delivering the message, we ask participants whether they heard it clearly and record a binary answer, yes or no. If the answer is no, we repeat the message.

The religious message is a verse from the Bible, Genesis 2:15. The secular message is taken from Article 5 of Burundi's Forest Code, *Loi n° 1/07 du 15 juillet 2016*. This law sets the legal framework for forest protection and management in Burundi. The neutral message states a simple fact about Burundi. It is common knowledge and is unrelated to either religion or the environment. We tested several prime messages during the pilots with students at the University of Burundi and farmers. We chose this set of messages based on how easy they are to understand and how clearly they match the intended treatment contrast. We also ensured that the Kirundi versions were similar in length and emotional tone, and that enumerators read them in the same neutral manner.

4.2 Sample

Our participants are forest users. Among them, 40.70% are charcoal producers or sellers, 26.45% are forest owners, 21.28% are carpenters, and 8.68% cut or sell firewood for cooking. The remaining 2.89% work in other smaller forest-related activities, such as making wooden art. Most participants are men, around 79%. The average participant is 42 years old, and around 80% are literate. Average monthly income is 199,239 FBU, or about USD 70 in 2026. On average, 49% of income comes from forest-related products and services.

The sample is predominantly Catholic. In total, 79.75% of participants identify as Catholic, 6.30% as Pentecostal, 2.07% as FECABU (Evangelical), 0.52% as Adventist, 0.21% as Anglican, and 0.72% as Muslim. Most of the remaining participants belong to other smaller Protestant or Christian denominations (10.23%), while 0.21% report no clear religious affiliation.[5] Participants are religious: 19.21% describe themselves as very religious, 47.00% as religious, and 33.78% as slightly religious. All but one participant believe in God, and all but two believe that God sees everything. Most participants, 97.52%, attend church at least once a week. In addition, 79.42% report praying at home, and 54.95% of those who pray at home report doing so every day.

Table 1: Baseline Characteristics by Treatment Group

Variable	T1	T2	T3
Demographics			
Female	0.216 (0.412)	0.258 (0.438)	0.273 (0.446)
Age	41.988 (13.696)	42.525 (14.002)	42.614 (13.548)
Literate	0.787 (0.410)	0.796 (0.404)	0.785 (0.411)
Geography			
Muramvya	0.373 (0.484)	0.330 (0.471)	0.350 (0.478)
Mwaro	0.293 (0.456)	0.330 (0.471)	0.322 (0.468)
Forest-sector profile			
Charcoal producer/seller	0.438 (0.497)	0.406 (0.492)	0.377 (0.485)
Forest owner	0.228 (0.420)	0.261 (0.440)	0.304 (0.461)
Carpenter	0.228 (0.420)	0.208 (0.406)	0.202 (0.402)
Firewood cutter/seller	0.068 (0.252)	0.107 (0.309)	0.086 (0.281)
Monthly income (FBU)	216,142 (161,683)	195,007 (151,598)	214,985 (263,509)
Income forest (%)	50.21 (22.291)	49.66 (23.107)	48.19 (23.224)
Hours/week forest work	37.50 (21.59)	35.59 (20.72)	35.39 (22.03)
Religious affiliation			
Catholic	0.799 (0.401)	0.814 (0.389)	0.779 (0.415)
Observations	324	318	326

Notes: The table reports group means, with standard deviations in parentheses. T1 is the religious-prime group, T2 is the secular-prime group, and T3 is the neutral-prime group. Muramvya and Mwaro are province indicators; Gitega is the omitted former province category. Profession indicators combine closed profession categories with reclassified open-text "Other" responses; residual activities are the omitted category. The Catholic indicator equals one for Catholic participants and zero otherwise.

All participants live and work in the province of Gitega. They are distributed across three former provinces of Burundi: Muramvya (35.12%), Mwaro (31.51%), and Gitega (33.37%).[6] We choose these former provinces

[5] There is no recent census on religious affiliation in Burundi. Available estimates from 2016 suggest that about 58.6% of Burundians are Catholic and 35.3% are Protestant. Muslims (3.4%), members of other religions (1.3%), and people reporting no religion (1.3%) make up small minorities; see (Zurlo, 2026) and (Naso and Budurha, 2024).

[6] Burundi reorganized its administrative divisions in 2025, merging these former provinces into the current province of Gitega.

because of their importance for either forest resources or demand for wood. Muramvya is close to Kibira National Park, a primary forest reserve. Gitega is the political capital of Burundi and faces high demand for forest products due to its growing population. Mwaro plays an important role in supplying forest products to markets in Bujumbura, the country's economic capital. Since there is no survey of forest users in Burundi from which to draw a sampling frame, we split the sample roughly equally across the three former provinces. This means that the sample should not be interpreted as representative of all forest users in Burundi. It represents adult forest users who were reachable in the selected recruitment sites across the three former provinces.

Participants were recruited by our field team at their workplaces, near regional markets, or in village centers. We approached potential participants directly. We included only participants who were at least 18 years old and derived income from forest products. The final sample includes 968 participants.

We implemented treatment assignment in the field using a pre-specified randomization procedure. After participants were screened and agreed to take part, enumerators drew a random allocation number with equal probability. This number assigned each participant to T1, T2, or T3, and enumerators had no discretion over treatment assignment. The final allocation was as follows: T1 (324 participants, 33.47%), T2 (318 participants, 32.85%), and T3 (326 participants, 33.68%).

Table 1 reports group means and standard deviations for observable and predetermined characteristics in four categories: demographics, geography, forest-sector characteristics, and religion. Pairwise balance tests show no statistically significant differences across the treatment groups.

Our initial sample-size target was about 760 participants, or approximately 253 participants per treatment group. This sample size provides 80% power, using a two-sided test with $\alpha = 0.05$, to detect pairwise effects of 0.25 standard deviations. Additional funding allowed us to extend data collection and increase the final sample size. Given the final group sizes, the minimum detectable pairwise effect is about 0.22 standard deviations.

4.3 Procedures

We conducted the experiment between August 2025 and January 2026. After checking eligibility and obtaining oral consent, enumerators read the protocol to participants. The order of implementation was the same for all participants. Enumerators first explained the public-goods game, especially the payoff structure, and used hypothetical scenarios to show how payments would be calculated. They then delivered the assigned prime and asked participants to make their contribution decision. After the experiment, enumerators administered a survey to collect demographic, forest-related, and religious information using Kobo Toolbox. The full session lasted about 45 minutes per participant. Participants were free to stop participating at any time, but no participant chose to stop.

For the contribution decision, enumerators gave each participant two envelopes and an initial endowment of 3,000 FBU, about USD 1 in 2026 and roughly half a day of work in rural Burundi. One envelope corresponded to the private account, and the other to the public account for forest conservation. Enumerators then left participants to divide the endowment in private. Groups were formed only after contribution decisions were made, so participants did not know the identity of the other group members and could not communicate with them before deciding. Participants kept the private-account envelope and returned the public-account envelope to the enumerator. A few months after the experiment was completed, we transferred the public-good returns to the randomly selected participants and the remaining funds to OBPE. In the survey, we also asked participants whether they trusted OBPE to protect Burundi's forests, and 92.67% reported that they did.

To assess participants' understanding of the experiment, we used three measures. Before the contribution decision, we asked whether participants had understood the explanation of the game and whether they were ready to play. All participants reported understanding the explanation, and all participants reported being ready to play. After the experiment, we again asked whether they had understood the activity. Only one participant reported not understanding it.[7] Focus group discussions conducted several weeks later provide further support for these findings: participants accurately described the main features of the experiment and explained specific aspects of its design.

We also assessed whether participants received and retained the assigned message. Virtually all participants reported hearing the message clearly, and 91.43% reported remembering it after the experiment.

4.4 Testable Hypotheses

We test the following hypotheses:

1. The religious prime leads to higher contributions to forest conservation than the neutral prime.
2. The secular prime leads to higher contributions to forest conservation than the neutral prime.
3. The religious prime leads to higher contributions to forest conservation than the secular prime.

[7] Table 8 in the Appendix reports these measures.

Contributing to forest conservation requires participants to bear a private monetary cost, while the resulting benefits are shared with others. The message primes may affect this decision by changing the non-monetary payoff associated with contributing. Among a religious sample, we expect the religious prime to activate a stewardship norm: the idea that humans have a moral duty to care for nature as part of God's creation. By increasing the moral payoff from acting consistently with this norm, the religious prime may offset part of the private cost of contributing and increase contributions relative to the neutral prime. The secular prime may similarly increase the non-monetary payoff from contributing by making forest conservation salient and activating a civic-duty norm grounded in environmental law. We expect the religious prime to have a stronger effect than the secular prime because religious norms may carry greater motivational force than legal appeals in a setting where religion and religious institutions play a more prominent role in everyday life than local government.[8]

We also examine heterogeneity in treatment effects. We test whether responses to the religious and secular primes vary by religiosity, religious affiliation, dependence on forest income, and pro-environmental perceptions.

We expect the religious prime to have a stronger effect among more religious participants, since the stewardship norm should be more salient to them. By contrast, we do not expect treatment effects to vary across Christian denominations. Genesis 2:15 is part of the Bible shared by Catholics, Protestants, and other Christians, and its message does not refer to a denomination-specific doctrine. We expect treatment effects to weaken as dependence on forest income increases, since conservation may impose higher opportunity costs on participants who rely more heavily on forest products. Finally, we expect the religious and secular primes to have stronger effects among participants with more pro-environmental perceptions, since the messages reinforce values they already hold.

5 Empirical Analysis

We first describe our econometric approach. We then present the main experimental results and the regression estimates corresponding to our testable hypotheses. Next, we examine heterogeneity in treatment effects. We conclude the section with robustness checks.

5.1 Econometric Approach

We estimate treatment effects using OLS:

$$y_i = \alpha + \beta_1 Religious_i + \beta_2 Secular_i + X_i'\gamma + \varepsilon_i, \tag{2}$$

where y_i is the share of the endowment contributed to forest conservation by participant i, defined as $y_i = c_i/E$. The variables $Religious_i$ and $Secular_i$ are indicators equal to one if participant i was assigned to T1 and T2. The neutral prime group is the omitted category. Thus, β_1 measures the effect of the religious prime relative to the neutral prime, while β_2 measures the effect of the secular prime relative to the neutral prime. We test whether the effects of the religious and secular primes differ using the null hypothesis $\beta_1 = \beta_2$.

We report the unadjusted specification as our primary estimate. We also report an adjusted specification that includes predetermined participant characteristics to improve precision and assess the robustness of the results. The vector X_i includes indicators for former province and profession, monthly income, the share of income derived from forest products, and hours worked in the forest sector. The term ε_i is the error term. Since treatment was assigned at the individual level and participants made their decisions privately before groups were formed, we do not cluster standard errors by public-goods group. We use robust standard errors throughout.

For the heterogeneity analysis, we estimate an extended version of the main specification. For each moderator Z_i, we estimate:

$$\begin{aligned} y_i = \alpha + \beta_1 Religious_i + \beta_2 Secular_i + \theta Z_i + \delta_1 (Religious_i \times Z_i) \\ + \delta_2 (Secular_i \times Z_i) + X_i'\gamma + \varepsilon_i. \end{aligned} \tag{3}$$

The neutral-prime group is the omitted treatment category. We estimate this model separately for each moderator. The moderators are religiosity, religious affiliation, dependence on forest income, and pro-environmental perceptions.

The coefficient δ_1 measures whether the association between Z_i and contributions differs between the religious-prime and neutral-prime groups. Similarly, δ_2 measures whether this association differs between the secular-prime and neutral-prime groups. The vector X_i includes the same controls as in the main specification, excluding Z_i when the moderator is already included in the control vector. We also use robust standard errors.

[8] Appendix Section 8.2 presents a simple model of norm satisfaction that formalizes this mechanism.

5.2 Main Results

Participants in the religious-prime group contribute an average of 0.247 of their endowment to forest conservation, compared with 0.228 in the secular-prime group and 0.220 in the neutral-prime group. The corresponding standard deviations were 0.184, 0.160, and 0.152, respectively. Across all treatment groups, the average contribution is 0.232, with a standard deviation of 0.166. Figure 1 displays the average share of endowment contributed to forest conservation by treatment group.

Table 2 reports the estimated treatment effects. In the unadjusted specification, the religious prime increases the share of the endowment contributed by 2.7 percentage points relative to the neutral prime. This is equivalent to a 12.27% increase in the amount contributed relative to the neutral prime mean. The estimate is statistically significant at the 5% level and remains unchanged when we add the control variables. The estimated effect of the secular prime is smaller, at 0.8 percentage points in the unadjusted specification, and is not statistically different from zero. The estimated difference between the religious and secular primes is approximately 1.8 percentage points, but it is also not statistically significant.

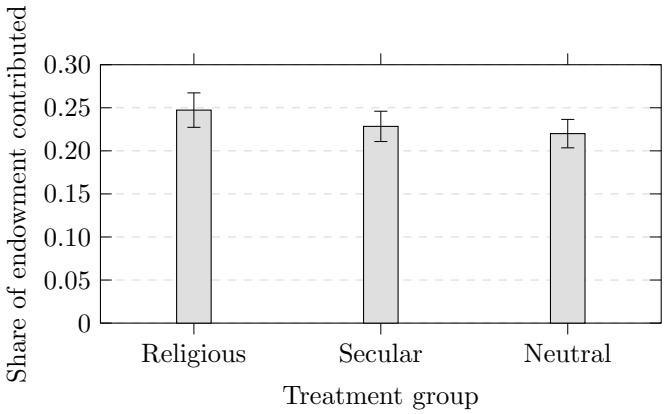


Figure 1: Average share of endowment contributed to forest conservation by treatment group. Error bars show 95% confidence intervals.

These results support Hypothesis 1: the religious prime leads to higher contributions than the neutral prime. However, we find no support for Hypotheses 2 and 3. The secular prime does not significantly increase contributions relative to the neutral-prime benchmark. Although the estimated effect of the religious prime is larger than that of the secular prime, the difference is not statistically significant.

Table 2: Treatment Effects on Contributions to Forest Conservation

	Share of endowment contributed	
	(1)	(2)
Religious prime	0.027**	0.027**
	(0.013)	(0.013)
Secular prime	0.008	0.009
	(0.012)	(0.012)
Neutral prime Mean	0.220	0.220
Controls	No	Yes
Observations	968	968
R-squared	0.005	0.012

Notes: The dependent variable is the share of the endowment contributed to forest conservation. The sample includes the religious-, secular-, and neutral-prime groups. The neutral-prime group is the omitted category. Robust standard errors are reported in parentheses. Controls include former province indicators, profession indicators, monthly income, the share of income from forest products, and hours of forest work. The baseline mean is the average share of the endowment contributed in the neutral-prime group. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

5.3 Heterogeneity Analysis

We examine heterogeneity in treatment effects by religiosity, religious affiliation, dependence on forest income, and pro-environmental perceptions.

5.3.1 Religiosity

We construct an index of religiosity using five equally weighted measures: self-reported religiosity (very religious, somewhat religious, or slightly religious), church attendance in a typical week, time spent on religious activities outside church in a typical week (in minutes), time spent reading the Bible (in minutes), and self-reported Bible knowledge (a binary measure equal to one if the respondent reports knowing the Bible well).

We first recode all variables so that higher values indicate higher religiosity. We then standardize each component by subtracting its mean and dividing by its standard deviation, and define the index as the average of these standardized components. The index has good internal consistency, with a Cronbach's alpha of 0.76. We then standardize the index itself, so a one-unit increase corresponds to a one-standard-deviation increase in religiosity.

Table 3 reports heterogeneity in treatment effects by religiosity. The interaction between the religious prime and the religiosity index is positive but small and statistically insignificant. In the specification with controls, a one-standard-deviation increase in religiosity is associated with a 0.6-percentage-point increase in the effect of the religious prime relative to the neutral prime. The interaction between the secular prime and religiosity is larger in magnitude and negative, at -1.9 percentage points, but is also statistically insignificant. We therefore find no evidence that the effects of either prime vary with participants' religiosity.

Table 3: Heterogeneity by Religiosity

	Share of endowment contributed	
	(1)	(2)
Religious prime	0.029**	0.028**
	(0.013)	(0.013)
Secular prime	0.009	0.009
	(0.012)	(0.012)
Religiosity index	0.008	0.009
	(0.011)	(0.011)
Religious prime × Religiosity index	0.007	0.006
	(0.016)	(0.016)
Secular prime × Religiosity index	-0.019	-0.019
	(0.014)	(0.014)
Controls	No	Yes
Observations	968	968
R-squared	0.010	0.017

Notes: The dependent variable is the share of the endowment contributed to forest conservation. The sample includes the religious-, secular-, and neutral-prime groups, with the neutral-prime group as the omitted category. The religiosity index is standardized, so the interaction coefficients correspond to a one-standard-deviation increase in religiosity. Robust standard errors are reported in parentheses. Column (1) reports estimates without controls. Column (2) includes former province indicators, profession indicators, monthly income, the share of income from forest products, and hours of forest work. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

A potential concern is that the religiosity measures were collected after the priming intervention. The religious prime could affect participants' reported religiosity, making the moderator partly endogenous to treatment assignment. For example, exposure to the religious message might lead some participants to report higher religiosity than they would report before the intervention. We examine this concern by testing whether treatment assignment predicts the religiosity index. As Table 9 in the Appendix shows, neither the religious nor the secular prime significantly affects the index, with or without controls. This provides reassurance that the heterogeneity estimates are not driven by treatment-induced changes in reported religiosity.

5.3.2 Religious Affiliation and Prior Exposure

We conduct two heterogeneity tests. First, we test whether treatment effects vary by religious affiliation. We divide participants into Catholics (79.75%), Protestants and other Christians (19.32%), and others (0.93%), including Muslims and participants with no clear religious affiliation. We compare treatment effects between the first two groups and exclude the third. Second, we test whether treatment effects vary with prior exposure to environmental messages in church services. In the survey, we ask whether participants had heard church leaders call for environmental protection during a service. In total, 82.75% report having heard such a message.

Table 4 reports the results. None of the interactions between the treatment indicators and Catholic affiliation is statistically significant at the 10% level. In the specification with controls, the interaction is 0.6 percentage points for the religious prime and 4.2 percentage points for the secular prime. The estimates

are similar without controls. These results indicate no overall evidence that treatment effects vary between Catholics and Protestants or other Christians.

Columns (3) and (4) of Table 4 also show no evidence that treatment effects vary with prior exposure to environmental messages in church. In the specification with controls, the interaction is 1.0 percentage point for both the religious and secular primes, but it is not statistically significant. The estimates are similar without controls and are likewise not statistically significant. We therefore find no evidence that prior exposure to environmental messages in church moderates the effect of either prime. Table 10 in the Appendix also shows that the religious and secular primes do not predict reported prior exposure to environmental messages in church.

Table 4: Heterogeneity by Religious Affiliation and Prior Church Exposure

	Share of endowment contributed			
	Religious affiliation		Prior church message	
	(1)	(2)	(3)	(4)
Religious prime	0.026	0.024	0.018	0.019
	(0.032)	(0.032)	(0.036)	(0.036)
Secular prime	-0.024	-0.023	-0.001	0.000
	(0.026)	(0.027)	(0.033)	(0.032)
Catholic	-0.025	-0.026	–	–
	(0.020)	(0.019)		
Prior environmental message in church	–	–	-0.039*	-0.038
			(0.024)	(0.024)
Religious prime × Catholic	0.004	0.006	–	–
	(0.035)	(0.035)		
Secular prime × Catholic	0.042	0.042	–	–
	(0.030)	(0.030)		
Religious prime × Prior church message	–	–	0.012	0.010
			(0.038)	(0.039)
Secular prime × Prior church message	–	–	0.011	0.010
			(0.035)	(0.035)
Controls	No	Yes	No	Yes
Observations	959	959	968	968
R-squared	0.008	0.015	0.010	0.017

Notes: The dependent variable is the share of the endowment contributed to forest conservation. Each column reports a separate regression using the religious-, secular-, and neutral-prime groups. The neutral-prime group is the omitted treatment category. Robust standard errors are reported in parentheses. Columns (1) and (2) examine heterogeneity by religious affiliation. Protestants and other Christians are the omitted affiliation category, and the sample excludes Muslims and participants with no religious affiliation. Columns (3) and (4) examine heterogeneity by prior exposure to environmental messages in church. Participants who had not previously heard such a message are the omitted category. Columns (1) and (3) report estimates without controls. Columns (2) and (4) include former province indicators, profession indicators, monthly income, the share of income from forest products, and hours of forest work. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

5.3.3 Dependence on Forest Income

We test whether treatment effects vary with the share of participants' income derived from forest products and services. We standardize this measure—the interaction terms correspond to a one-standard-deviation increase in forest-income dependence. The original variable is omitted from the control vector.

Table 5 displays our results. In the specification with controls, a one-standard-deviation increase in forest-income dependence is associated with a 1.4-percentage-point increase in the effect of the religious prime relative to the neutral prime. The corresponding interaction for the secular prime is negative, at 1.5 percentage points. Neither interaction is statistically significant. The estimates are similar without controls. This provides no evidence that the effect of either prime varies with participants' dependence on forest income.

Table 5: Heterogeneity by Dependence on Forest Income

	Share of endowment contributed	
	(1)	(2)
Religious prime	0.027**	0.026**
	(0.013)	(0.013)
Secular prime	0.009	0.010
	(0.012)	(0.012)
Forest-income dependence	-0.004	0.000
	(0.009)	(0.010)
Religious prime × Forest-income dependence	0.014	0.014
	(0.014)	(0.014)
Secular prime × Forest-income dependence	-0.013	-0.015
	(0.013)	(0.013)
Controls	No	Yes
Observations	968	968
R-squared	0.010	0.017

Notes: The dependent variable is the share of the endowment contributed to conservation. The sample includes the religious-, secular-, and neutral-prime groups, with the neutral-prime group as the omitted treatment category. Forest-income dependence is the standardized share of income derived from forest products and services. The interaction coefficients correspond to a one-standard-deviation increase in forest-income dependence. Robust standard errors are reported in parentheses. Column (1) reports estimates without controls. Column (2) includes former province indicators, profession indicators, monthly income, and hours of forest work. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

5.3.4 Pro-environmental perceptions

We collected six measures of pro-environmental perceptions. Four capture beliefs about the benefits of forests for air, soil, rainfall, and climate, while two capture support for and willingness to shift away from wood-based income. As Table 11 in the Appendix shows, the first four measures show almost no variation, as nearly all participants recognize these benefits. We therefore use willingness to shift to a more environmentally friendly source of income as the moderator in our heterogeneity regressions. This measure is more behaviourally meaningful than general support for such a shift, and the two measures overlap substantially. In total, 55.99% of participants report being willing to shift.

Table 6: Heterogeneity by Willingness to Shift to Greener Income Sources

	Share of endowment contributed	
	(1)	(2)
Religious prime	0.049**	0.047**
	(0.019)	(0.019)
Secular prime	0.011	0.011
	(0.018)	(0.018)
Willing to shift	0.008	0.001
	(0.017)	(0.017)
Religious prime × Willing to shift	-0.039	-0.036
	(0.027)	(0.027)
Secular prime × Willing to shift	-0.006	-0.003
	(0.025)	(0.025)
Controls	No	Yes
Observations	968	968
R-squared	0.008	0.016

Notes: The dependent variable is the share of the endowment contributed to forest conservation. The sample includes the religious-, secular-, and neutral-prime groups, with the neutral-prime group as the omitted treatment category. Participants unwilling to shift to a greener income source are the omitted moderator category. The interaction coefficients measure whether the difference between willing and unwilling participants varies between the religious or secular prime and the neutral prime. Robust standard errors are reported in parentheses. Column (1) reports estimates without controls. Column (2) includes former province indicators, profession indicators, monthly income, the share of income from forest products, and hours of forest work. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6 reports the results. In the specification with controls, the interaction between the religious prime and willingness to shift is negative, at 3.6 percentage points, while the interaction with the secular prime is close to zero, at 0.3 percentage points. Neither interaction is statistically significant, and the estimates are

similar without controls. These estimates provide no evidence that willingness to shift to a greener income source changes the effect of either prime.

Again, a potential concern is that the primes may have affected participants' pro-environmental perceptions, since these were measured after the intervention. Table 12 in the Appendix examines this concern by regressing willingness to shift to a more environmentally friendly source of income on the treatment indicators. We find no evidence that either prime affects this outcome.

5.4 Robustness Checks

We conduct several robustness checks.

Alternative functional form. We estimate fractional-logit models for the contribution share and report average marginal effects in Table 14 in the Appendix. This checks whether the results depend on using OLS for a bounded dependent variable. The religious prime increases contributions by 2.7 percentage points relative to the neutral prime, both without and with controls, and the estimates are statistically significant at the 5% level. The estimated effect of the secular prime is smaller, at 0.8–0.9 percentage points, and is not statistically significant. These estimates are nearly identical to the OLS results in both sign and magnitude.

Multiple-testing adjustment. We adjust for multiple testing using Holm-adjusted (p)-values for the three pairwise comparisons corresponding to our main hypotheses (Table 13 in the Appendix). The adjusted (p)-value for the religious-neutral comparison is 0.120, while those for the religious-secular and secular-neutral comparisons are 0.392 and 0.497, respectively. Thus, none of the comparisons remains statistically significant at conventional levels after adjusting for multiple testing.

Enumerator fixed effects. We test whether the main results are sensitive to the inclusion of enumerator fixed effects, which account for systematic differences in the administration of the experiment across enumerators. As shown in Table 15 in the Appendix, the religious-prime estimate is 2.6 percentage points without controls and 2.4 percentage points with controls. The corresponding secular-prime estimates are close to zero. These results are similar to the main estimates.

Randomization inference. We calculate randomization-inference (p)-values by repeatedly permuting treatment assignment while preserving the realized treatment-group sizes. Table 16 in the Appendix reports results based on 10,000 permutations. The religious-neutral comparison remains statistically significant at the 5% level, with two-sided (p)-values of 0.036 without controls and 0.037 with controls. The secular-neutral and religious-secular comparisons remain statistically insignificant.

Neutral Prime versus No-Prime Control. We examine whether the neutral message affects contributions independently of its content. We compare contributions in the neutral-prime group with those in a new no-prime control group. Data for this group were collected a few months after the main data collection, between December 2025 and January 2026. We followed the same recruitment, eligibility, public-goods-game, payment, and survey procedures. The only difference was that participants in the no-prime group received no message before making their contribution decision.

Table 7: Neutral Prime versus No-Prime Control

	Share of endowment contributed	
	(1)	(2)
Neutral prime	0.003	0.000
	(0.014)	(0.014)
No-prime control mean	0.217	0.217
Controls	No	Yes
Observations	491	491
R-squared	0.000	0.019

Notes: The dependent variable is the share of the endowment contributed to forest conservation. The sample includes participants assigned to the neutral-prime group and the no-prime control group. The no-prime control group is the omitted category. The coefficient therefore measures the difference in contributions between participants who received the neutral message and those who received no message. Robust standard errors are reported in parentheses. Column (1) reports estimates without controls. Column (2) includes former province indicators, profession indicators, monthly income, the share of income from forest products, and hours of forest work. The neutral-prime group was collected between August and October 2025, while the no-prime control group was collected between December 2025 and January 2026. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

This comparison tests whether simply receiving a message changes participants' behaviour, for example by increasing attention, generating experimenter-demand effects, or inducing other forms of behavioural reactivity. We estimate the difference both without and with controls. Since the no-prime group was collected in a later phase, this comparison may also capture changes between data-collection periods. We therefore interpret the results as suggestive rather than as a clean causal estimate of the neutral message's effect.

Table 7 shows no statistically significant difference in contributions between the neutral-prime and no-prime control groups. The estimated difference is 0.3 percentage points without controls and is close to zero after controls are added. The no-prime control group includes 165 participants and contributed an average of 0.217 of the endowment, with a standard deviation of 0.138. These results provide little evidence that simply receiving a neutral message affected contributions.

6 Discussion

Our results show that a religious stewardship message increases contributions to forest conservation. Participants assigned to the religious-prime group contribute about 2.7 percentage points more of their endowment than participants assigned to the neutral-prime group. The secular prime has a smaller and statistically insignificant effect, and the difference between the religious and secular primes is not statistically significant. Our robustness checks support the same pattern, except for the multiple-testing adjustment. Thus, the evidence is insufficient to rule out that the religious–neutral result arose by chance across the three pairwise comparisons.

The heterogeneity results do not show clear differences by religiosity, religious affiliation, prior exposure to environmental messages in church, dependence on forest income, or willingness to shift to greener income sources. This suggests that the religious-prime effect is not limited to the most religious participants or to those already more favourable to environmental change. Instead, the prime may work through activating a religious norm that is broadly shared in this setting.

We interpret the results through a norm-satisfaction mechanism. Contributing requires participants to bear a private monetary cost, while the resulting conservation benefits are shared with others. The religious prime makes stewardship toward nature more salient and activates a religious stewardship norm. Participants then interpret contributing to forest conservation as a way to act on this norm. This increases the moral payoff from contributing and leads participants to give more. Since contributing is costly, this effect is especially meaningful in a sample of forest users whose livelihoods depend on forest extraction.

We cannot identify this mechanism directly, and other channels may also contribute to the effect. We therefore use the survey and recall data to assess whether the evidence is more consistent with stewardship than with plausible alternatives. We first present descriptive evidence that stewardship is a widely shared norm and that many participants recalled the religious prime as a message about care for nature. We then discuss four alternative explanations: environmental guilt, divine monitoring or supernatural punishment, familiarity with biblical language, and the greater concreteness of the religious message relative to the secular message. The evidence is not conclusive, but it favours stewardship over these alternatives.

Shared norm. Almost all participants endorse religious stewardship statements: 99.07% agree that God wants people to care for creation, including forests, water, and land, and 98.66% agree that their religion teaches them a duty to protect forests when possible. These variables show too little variation for meaningful heterogeneity tests, but they indicate that stewardship is a widely shared norm in our setting.

Recall evidence. Post-experiment recall responses provide further suggestive evidence. Among participants in the religious-prime group, 32.4% recalled the message predominantly using language related to caring for, protecting, keeping, or preserving the garden, forest, or environment, rather than explicitly religious language. Under a broader definition that also includes working, cultivating, or managing the garden, this share rises to 50.8%. These responses suggest that many participants did not recall the prime merely as a generic religious statement, but as a message linking religious language to care for nature.

Environmental guilt. The main results already point against environmental guilt as the primary channel. If the religious prime mainly worked by making forest users feel guilty about forest extraction, we might expect the secular Forest Code message to have a similar effect, since it also makes forest protection salient. Instead, we find a statistically significant effect only for the religious prime relative to the neutral prime, while the secular prime has a smaller and statistically insignificant effect. Moreover, if guilt were driving the result, we would expect the religious-prime effect to be stronger among participants who derive more income from forest products, spend more hours in forest-sector work, or work in occupations more directly linked to extraction. We do not find this pattern. The heterogeneity results show that the interaction with forest-income dependence is not statistically significant. Additional regressions also show that the interactions with forest-sector hours and charcoal or firewood occupation are not statistically significant (Table 5 and Appendix Table 17).

Supernatural punishment. Another possibility is that the religious prime activates divine monitoring or fear of supernatural punishment. This channel is plausible in our setting: almost all participants believe in God (99.90%), believe that God sees everything they do (99.79%), and believe that God can become angry if someone does harm (98.91%). These variables have too little variation for meaningful heterogeneity tests, so we cannot rule out this explanation. Still, we do not think it is the most direct interpretation. The religious prime itself does not mention divine monitoring, punishment, anger, judgment, or fear. It instead describes God placing man in the Garden of Eden to cultivate it and care for it.

Familiarity with the religious message. The religious message may also have been more effective because participants were more familiar with biblical language than with the secular message. Two pieces of evidence provide little support for this interpretation. First, as shown in the heterogeneity analysis, the religious-prime effect is not stronger among participants who had previously heard church leaders call for environmental protection. Second, we conduct an additional check using self-reported Bible knowledge. If familiarity were the main channel, we would expect the religious-prime effect to be stronger among participants who report knowing the Bible well. We do not find this pattern: the interaction with Bible knowledge is small and statistically insignificant (Appendix Table 18). These tests are indirect, since we do not observe familiarity with Genesis 2:15 itself, but they provide little support for familiarity as the main explanation for the religious-prime effect.

Concreteness of the religious message. A final possibility is that the religious prime is more effective because it is more concrete than the secular message. We do not directly measure perceived concreteness, so we cannot test this mechanism cleanly. As an indirect check, we examine message recall, since a more concrete message may be easier to remember. Participants in the religious-prime group are more likely to remember the message than participants in the neutral-prime group, while recall in the secular-prime group is not significantly different from recall in the neutral-prime group (Appendix Table 19). This suggests that memorability, and potentially concreteness, may be part of the story. Still, given the open-ended recall responses discussed above, we believe that stewardship remains the most plausible mechanism. The religious message may have been more concrete, but the content that participants remembered was largely about caring for, protecting, preserving, working, cultivating, or managing nature.

7 Conclusion

This paper asks whether religious messaging can help address an environmental collective-action problem among people whose livelihoods depend on forest resources. We address this question through a randomized field experiment with forest users in rural Burundi, comparing a biblical stewardship message, a secular conservation message, and a neutral message in a conservation-framed public-goods game. The religious message increases contributions relative to the neutral message, while the secular message has no statistically significant effect. The estimated effect of the religious message is larger than that of the secular message, but the difference between them is not statistically significant. We also find no evidence that treatment effects vary across the participant characteristics we examine.

Taken together, our findings suggest that religion can help address environmental collective-action problems by increasing individuals' willingness to bear private costs for a shared environmental benefit. By framing forest conservation as a religious duty, stewardship messaging may strengthen cooperation around a common environmental objective. This is particularly noteworthy in our setting, where participants depend directly on forest resources and therefore face a tension between private economic interests and collective conservation.

These findings should not be interpreted as representative of all forest users in Burundi. In the absence of a survey or census from which to construct a sampling frame, we recruited adult forest users who were reachable at selected workplaces and markets across three former provinces. Most forest users operate in regional and local markets, although some do not. If forest users reached at workplaces and markets are somewhat wealthier than harder-to-reach users, our estimate could overstate the population-wide effect, since the fixed experimental contribution may represent a smaller economic sacrifice for them. Our sample is religious, as is the wider Burundian population, although its religious composition differs from available national estimates. In particular, Catholics are more heavily represented in our sample than in the Burundian population. However, our heterogeneity analysis provides no evidence that the effect of the intervention differs between Catholics and Protestants or other Christians.

Our findings are most likely to extend to other religious, resource-dependent contexts in Sub-Saharan Africa and, more broadly, the developing world, particularly where stewardship is a widely shared norm. Beyond forests, the same logic may also apply to the conservation of other natural resources, such as water, especially where individual contributions or restraint support a collective environmental objective. A further condition is that people trust the organization responsible for implementing conservation activities, since distrust could weaken the perceived link between contributing and supporting conservation.

These results suggest two policy applications. First, environmental agencies could partner with churches and religious leaders to incorporate stewardship messages into reforestation campaigns and community forest-management activities. Second, such messages could be integrated into existing conservation programmes, where they would have a low marginal delivery cost. The potential of these applications is supported by evidence that other brief conservation messages have produced behavioural responses of a similar magnitude. In Namibia, a one-off SMS providing specific water-conservation strategies reduced water consumption by 5.3% (Tonke, 2024). In Cape Town, behavioural messages delivered with monthly utility bills reduced water consumption by 0.6–1.3% (Brick et al., 2023). Unlike these broader household interventions, ours focused on forest users whose livelihoods depend on forest resources, making it both more directly relevant to environmental policy and a more demanding test.

8 Appendix

8.1 Procedures

Table 8: Participants' Understanding of the Experiment

	Yes (%)	No (%)	Observations
Understood the explanation of the game	100.00	0.00	968
Ready to play	100.00	0.00	968
Understood the activity after the experiment	99.90	0.10	968

Notes: The table reports participants' responses to three questions assessing their understanding of the experiment. The first two questions were asked after the game had been explained and before participants made their contribution decisions. The third question was asked after the experiment.

8.2 A Simple Model of Norm Satisfaction

We present a simple model of the mechanism discussed in section 4.4. The model extends the standard public-goods payoff by allowing participants to derive utility from satisfying a norm.

Participant i receives endowment E and chooses contribution $c_i \in [0, E]$. Let C_{-i} denote the total contribution of the other three participants in the group. Total group contribution is

$$S = c_i + C_{-i}.$$

The monetary payoff of participant i is

$$x_i = E - c_i + rS,$$

Assume that $r \in (0, 1)$. A higher contribution therefore reduces the participant's private monetary payoff by $1 - r$.

Let T_i denote norm satisfaction. This is the extent to which participant i's contribution is consistent with the norm activated by the assigned prime. Let $D_i \in R, Sec, N$ denote the assigned prime, where R is the religious prime, Sec is the secular prime, and N is the neutral prime. Norm satisfaction is written as

$$T_i = T_i(c_i, D_i).$$

Participant i chooses c_i to maximize

$$U_i(x_i, T_i),$$

subject to the monetary payoff and norm-satisfaction equations above. We can rewrite the problem as

$$\max_{c_i \in [0,E]} U_i \left(E - c_i + r(c_i + C_{-i}), T_i(c_i, D_i)\right).$$

We assume that utility is increasing in monetary payoff, $U_x > 0$ and is concave, $U_{xx} < 0$. We also assume that the utility function is weakly increasing in norm satisfaction, $U_T \geq 0$.

If the participant values the activated norm, then $U_T > 0$. If the norm is not activated, or if the participant does not care about it, then $U_T = 0$.

The first-order condition for an interior solution is obtained by the chain rule:

$$U_x \frac{\partial x_i}{\partial c_i} + U_T \frac{\partial T_i}{\partial c_i} = 0.$$

We can rewrite this condition,

$$U_x(r - 1) + U_T T_c(c_i, D_i) = 0.$$

The first term of the left-hand side is the marginal utility cost of contributing, which is negative since $U_x > 0$ and $r < 1$. The second term is the marginal utility benefit from norm satisfaction. The sign of this term depends on U_T and $T_c(c_i, D_i)$. There are three relevant cases.

Case 1. The norm may be activated and valued, and contribution may satisfy it. Then, $U_T > 0$ and $T_c(c_i, D_i) > 0$. In this case,

$$U_T T_c(c_i, D_i) > 0.$$

The norm-satisfaction term offsets part of the private monetary cost of contributing. At $c_i = 0$, a positive contribution is optimal if the marginal norm-satisfaction benefit is larger than the marginal utility cost of giving, $U_T T_c(0, D_i) > (1 - r)U_x$.

Under this condition, utility increases when the participant moves away from zero contribution. Therefore, $c_i = 0$ is no longer optimal and the participant chooses $c_i > 0$.

Case 2. The norm may not affect utility. This can happen if the norm is not activated, or if the participant does not care about it. Then, $U_T = 0$. In this case,

$$U_T T_c(c_i, D_i) = 0.$$

The norm-satisfaction term does not affect the contribution decision.

Case 3. The participant may value the norm, but the contribution may not be seen as satisfying that norm. Then, $U_T > 0$ but $T_c(c_i, D_i) = 0$. In this case too,

$$U_T T_c(c_i, D_i) = 0.$$

Testable Hypotheses. We posit that the religious-prime mechanism corresponds to the first case. The religious prime makes stewardship toward nature salient. This increases the link between contribution and norm satisfaction.

$$T_c(c_i, R) > T_c(c_i, N).$$

If $U_T > 0$, then

$$U_T T_c(c_i, R) > U_T T_c(c_i, N).$$

The religious prime therefore raises the marginal utility benefit of contributing. This increases the optimal contribution.

We also posit that the religious prime has a stronger predicted effect than the secular prime if it creates a stronger link between contribution and norm satisfaction. This means

$$T_c(c_i, R) > T_c(c_i, Sec) \geq T_c(c_i, N).$$

Again, if $U_T > 0$, then

$$U_T T_c(c_i, R) > U_T T_c(c_i, Sec) \geq U_T T_c(c_i, N).$$

The religious prime therefore increases the marginal norm-satisfaction benefit of contributing more than the secular prime. This implies a higher optimal contribution under the religious prime.

8.3 Heterogeneity Analysis

8.3.1 Religiosity

Table 9: Treatment Effects on the Religiosity Index

	Religiosity index	
	(1)	(2)
Religious prime	-0.118	-0.101
	(0.079)	(0.077)
Secular prime	-0.056	-0.026
	(0.079)	(0.079)
Controls	No	Yes
Observations	968	968
R-squared	0.002	0.041

Notes: The dependent variable is the standardized religiosity index. The sample includes the religious-, secular-, and neutral-prime groups, with the neutral-prime group as the omitted category. The coefficients therefore measure the effects of the religious and secular primes relative to the neutral prime. Robust standard errors are reported in parentheses. Column (1) reports estimates without controls. Column (2) includes former province indicators, profession indicators, monthly income, the share of income from forest products, and hours of forest work. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

8.3.2 Religious Affiliation and Prior Exposure

Table 10: Treatment Effects on Reported Prior Church Exposure

	Prior environmental message in church	
	(1)	(2)
Religious prime	-0.004	-0.006
	(0.030)	(0.030)
Secular prime	-0.007	-0.007
	(0.030)	(0.029)
Controls	No	Yes
Joint test p-value	0.970	0.967
Observations	968	968
R-squared	0.000	0.029

Notes: The dependent variable equals one if the participant reports having previously heard a church leader call for environmental protection during a church service. The table reports estimates from linear probability models using the religious-, secular-, and neutral-prime groups. The neutral-prime group is the omitted category. The coefficients therefore measure differences in reported prior exposure relative to the neutral-prime group. Robust standard errors are reported in parentheses. Column (1) reports estimates without controls. Column (2) includes former province indicators, profession indicators, monthly income, the share of income from forest products, and hours of forest work. The joint-test p-value corresponds to the null hypothesis that the coefficients on the religious and secular primes are jointly equal to zero. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

8.3.3 Pro-environmental Perceptions

Table 11: Pro-environmental Perceptions

Statement	Yes (%)	No (%)	Observations
Forests regulate air quality	99.59	0.41	968
Forests improve soil quality	99.28	0.72	968
Forests support rainfall	99.59	0.41	968
Forests help limit climate change	98.66	1.34	967
Shifting away from wood-based income is important	69.11	30.89	968
Willing to shift to a greener income source	55.99	44.01	968

Notes: The table reports responses among participants in the religious-, secular-, and neutral-prime groups. The first five rows report the percentage of participants who agreed or disagreed with each statement. The final row reports willingness to shift from wood-based activities to a more environmentally friendly source of income.

Table 12: Treatment Effects on Willingness to Shift to Greener Income Sources

	Willing to shift	
	(1)	(2)
Religious prime	0.007	0.014
	(0.039)	(0.038)
Secular prime	0.008	0.011
	(0.039)	(0.038)
Controls	No	Yes
Joint test p-value	0.978	0.932
Observations	968	968
R-squared	0.000	0.075

Notes: The dependent variable equals one if the participant reports being willing to shift from wood-based activities to a more environmentally friendly source of income. The table reports estimates from linear probability models using the religious-, secular-, and neutral-prime groups. The neutral-prime group is the omitted treatment category. The coefficients therefore measure differences in reported willingness to shift relative to the neutral-prime group. Robust standard errors are reported in parentheses. Column (1) reports estimates without controls. Column (2) includes former province indicators, profession indicators, monthly income, the share of income from forest products, and hours of forest work. The joint-test p-value corresponds to the null hypothesis that the coefficients on the religious and secular primes are jointly equal to zero. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

8.4 Robustness Checks

8.4.1 Multiple-testing Adjustment

Table 13: Holm-Adjusted P-Values for Main Pairwise Treatment Comparisons

	Estimate	Std. error	Unadjusted p-value	Holm-adjusted p-value
Religious vs. neutral	0.027	0.013	0.040	0.120
Secular vs. neutral	0.008	0.012	0.497	0.497
Religious vs. secular	0.018	0.014	0.196	0.392

Notes: The dependent variable is the share of the endowment contributed to forest conservation. Estimates come from the primary specification using the religious-, secular-, and neutral-prime groups. The table reports the three pairwise comparisons corresponding to the prespecified hypotheses. Holm-adjusted p-values control the family-wise error rate across these three comparisons. The specification does not include controls. Robust standard errors are reported.

8.4.2 Alternative Functional Form

Table 14: Alternative Functional Form: Fractional-Logit Average Marginal Effects

	Share of endowment contributed	
	(1)	(2)
Religious prime	0.027**	0.027**
	(0.013)	(0.013)
Secular prime	0.008	0.009
	(0.012)	(0.012)
Controls	No	Yes
Observations	968	968
Pseudo R-squared	0.001	0.002

Notes: The table reports average marginal effects from fractional-logit models. The dependent variable is the share of the endowment contributed to forest conservation. The sample includes participants assigned to the religious-, secular-, and neutral-prime groups. The neutral-prime group is the omitted category. The reported effects are discrete changes relative to the neutral-prime group. Robust delta-method standard errors are reported in parentheses. Column (1) reports estimates without controls. Column (2) includes former province indicators, profession indicators, monthly income, the share of income from forest products, and hours of forest work. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

8.4.3 Enumerators fixed effects

Table 15: Treatment Effects with Enumerator Fixed Effects

	Share of endowment contributed	
	(1)	(2)
Religious prime	0.026**	0.024*
	(0.013)	(0.013)
Secular prime	0.005	0.005
	(0.012)	(0.012)
Controls	No	Yes
Enumerator fixed effects	Yes	Yes
Observations	968	968
R-squared	0.052	0.059

Notes: The dependent variable is the share of the endowment contributed to forest conservation. The sample includes participants assigned to the religious-, secular-, and neutral-prime groups. The neutral-prime group is the omitted category. Enumerator fixed effects are based on the first digit of the respondent identifier. Robust standard errors are reported in parentheses. Column (1) includes enumerator fixed effects without additional controls. Column (2) also includes former province indicators, profession indicators, monthly income, the share of income from forest products, and hours of forest work. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

8.4.4 Randomization Inference

Table 16: Randomization Inference for Main Pairwise Treatment Comparisons

	Share of endowment contributed	
	(1)	(2)
Religious vs. neutral	0.027**	0.027**
	[0.036]	[0.037]
Secular vs. neutral	0.008	0.009
	[0.537]	[0.507]
Religious vs. secular	0.019	0.018
	[0.140]	[0.169]
Controls	No	Yes
Observations	968	968
Permutations	10,000	10,000

Notes: The dependent variable is the share of the endowment contributed to forest conservation. The sample includes participants assigned to the religious-, secular-, and neutral-prime groups. The table reports the three pairwise comparisons corresponding to the main hypotheses. Two-sided randomization-inference p-values based on 10,000 permutations of treatment assignment are reported in brackets. Column (1) reports estimates without controls. Column (2) includes former province indicators, profession indicators, monthly income, the share of income from forest products, and hours of forest work. Significance levels are based on the randomization-inference p-values: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

8.5 Discussion

Table 17: Mechanism Checks for Environmental Guilt

	Share of endowment contributed			
	Hours in forest-sector work		Charcoal/firewood workers	
	(1)	(2)	(3)	(4)
Religious prime	0.027**	0.026**	0.011	0.012
	(0.013)	(0.013)	(0.019)	(0.019)
Secular prime	0.008	0.009	-0.014	-0.014
	(0.012)	(0.012)	(0.018)	(0.018)
Forest-sector hours	-0.010	-0.008	–	–
	(0.008)	(0.010)		
Charcoal/firewood worker	–	–	-0.043***	-0.043**
			(0.016)	(0.017)
Religious prime × Forest-sector hours	0.020	0.019	–	–
	(0.012)	(0.012)		
Secular prime × Forest-sector hours	-0.001	-0.003	–	–
	(0.013)	(0.013)		
Religious prime × Charcoal/firewood worker	–	–	0.036	0.034
			(0.026)	(0.026)
Secular prime × Charcoal/firewood worker	–	–	0.049**	0.047*
			(0.024)	(0.024)
Controls	No	Yes	No	Yes
Observations	968	968	968	968
R-squared	0.009	0.016	0.011	0.013

Notes: The dependent variable is the share of the endowment contributed to forest conservation. Each column reports a separate regression using the religious-, secular-, and neutral-prime groups. The neutral-prime group is the omitted treatment category. Columns (1) and (2) examine heterogeneity by hours worked in the forest sector. Forest-sector hours are standardized, so the interaction coefficients correspond to a one-standard-deviation increase in hours worked. Columns (3) and (4) examine heterogeneity by direct extraction occupation. Charcoal/firewood worker is an indicator equal to one for charcoal producers or sellers and firewood cutters or sellers. Columns (1) and (3) report estimates without controls. Column (2) includes former province indicators, profession indicators, monthly income, and the share of income from forest products. Column (4) includes former province indicators, monthly income, the share of income from forest products, and hours of forest work. Robust standard errors are reported in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 18: Heterogeneity by Bible Knowledge

	Share of endowment contributed	
	(1)	(2)
Religious prime	0.031	0.031
	(0.019)	(0.019)
Secular prime	0.017	0.017
	(0.018)	(0.018)
Knows Bible well	0.010	0.010
	(0.017)	(0.017)
Religious prime × Knows Bible well	-0.006	-0.007
	(0.026)	(0.026)
Secular prime × Knows Bible well	-0.015	-0.014
	(0.024)	(0.025)
Controls	No	Yes
Observations	968	968
R-squared	0.005	0.012

Notes: The dependent variable is the share of the endowment contributed to forest conservation. The sample includes the religious-, secular-, and neutral-prime groups, with the neutral-prime group as the omitted treatment category. The variable "Knows Bible well" equals one for participants who report knowing the Bible well and zero otherwise. Column (1) reports estimates without controls. Column (2) includes former province indicators, profession indicators, monthly income, the share of income from forest products, and hours of forest work. Robust standard errors are reported in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 19: Treatment Effects on Message Recall

	Remembered the message	
	(1)	(2)
Religious prime	0.061***	0.062***
	(0.021)	(0.021)
Secular prime	0.013	0.017
	(0.024)	(0.024)
Neutral-prime mean	0.890	0.890
Controls	No	Yes
Observations	968	968
R-squared	0.009	0.026

Notes: The dependent variable equals one if the participant reported remembering the message that was read before the contribution decision. The sample includes the religious-, secular-, and neutral-prime groups, with the neutral-prime group as the omitted treatment category. The neutral-prime mean is the average recall rate in the neutral-prime group. Column (1) reports estimates without controls. Column (2) includes former province indicators, profession indicators, monthly income, the share of income from forest products, and hours of forest work. Robust standard errors are reported in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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