Growing Awareness: Evaluating the Impact of Environmental Education on Attitudes, Knowledge, and Behavior

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Abstract

Mangroves provide vital ecosystem services, including storm surge protection, marine nurseries, and carbon sequestration, yet their coverage is rapidly declining. This study evaluates a randomized control trial of an environmental education program in the Dominican Republic aimed at increasing awareness of mangroves' ecological value. We assessed impacts on children's knowledge, attitudes, behaviors, and willingness to pay (WTP) for conservation-related goods. We also examined spillover effects on peers and parents. The program improved children's attitudes toward mangroves, with stronger effects among girls, and changes in behaviors and WTP were modestly positive but not statistically significant. We also find evidence of spillovers to peers and parents. Non-treated peers in clubs where 75-percent of players were treated show an increase in preference for mangroves compared to children in clubs where no child was treated. Parents of participating children showed positive changes in environmental attitudes and behaviors.

JEL Classification Codes: Q57, I25, C93

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1 Introduction

Mangroves play an essential role in healthy marine ecosystems, serving as a nursery for coral reef fish, mitigating environmental damage by shielding communities from tropical storm damage, and trapping carbon (Sathirathai & Barbier 2001, Barbier 2006). Mangroves have been shown to be of particular importance in protecting coastal communities from storm surges (Badola & Hussain 2005, Barbier 2007, 2008, Huxham et al. 2015, Hochard et al. 2019, Del Valle et al. 2020), which are expected to become more frequent and intense as climate change continues. However, since 1996, over 1,000 km2 of mangroves have been lost or degraded, and current data show an average loss rate of 0.21% annually – higher than for other tropical and subtropical forests. 105 out of 108 countries with mangroves have recorded losses over the same period (IUCN 2021).

One potential driver of mangrove loss, as with many environmental challenges, is a lack of awareness of the services that the ecosystem provides to communities living nearby. In this paper, we use a randomized controlled trial of an environmental education program in the Dominican Republic (D.R.) to elucidate the impacts of education on knowledge, attitudes, and behaviors. An estimated 70 percent of the population in the Dominican Republic is at high risk for floods and severe storms, yet mangrove coverage in the D.R. has dropped by one-third over the past 50 years (Seacology, 2022). The purpose of the educational intervention is to change negative perceptions of mangroves and associated behaviors starting with children (Van De Wetering et al. 2022), with the expectation that this education can reduce future mangrove loss. We evaluate the direct effects of the program across several dimensions, including children's awareness of the existence and value of mangroves, environmental behaviors, and willingness to pay for products associated with mangrove conservation. We further assess whether this knowledge spills over onto peers in the same participating clubs who do not directly experience the program, and if parents also absorb the knowledge that their children acquire from the training.

The intervention leverages youth sports programs, focusing on volleyball and basketball clubs to target girls and baseball teams to target boys. We identified 32 sports clubs to participate in the experiment and randomized across treatment and control. Treated children received an approximately 90-minute class that covered the importance of mangroves for environmental services, including protection of communities from storm surge, refuge for pollinators, and incubators for fish. The hands-on program integrated trash pickup and children working together to identify and record as many species of plants, animals, fungi, and other organisms as possible in a nearby mangrove. The course was delivered by biologists within Grupo Jaragua, a D.R. NGO.[1] Control-group children received a class of similar length covering art history. To test for

[1] Grupo Jaragua describes their mission as: "Contribute to the conservation of biodiversity and associated ecosystem services in Hispaniola Island, in collaboration with local communities and using the best available science."

spillovers, we employed two treatment arms. The first treatment arm treated a randomly selected 75 percent of the children in the club, while the second treated a randomly selected 50 percent of the children. This randomizes the potential exposure to spillovers across children in treated clubs.

We measure impact using changes in our metrics of knowledge, environmental attitudes, and environmental behaviors measured using baseline and endline surveys of the children involved in the clubs and one of their parents. We were also interested in understanding whether the education program increased children and adult willingness to pay for products that come from mangroves. To do this, during the end-line survey, we offered to sell a random subset of participants a jar of honey collected from D.R. mangroves. Our general outcomes and estimation strategy are registered, along with a pre-analysis plan, in the AEARCT registry.

Among youth who participated in the mangrove education program, we observed no significant increase in concerns about global environmental issues, but a positive effect on attitudes and perceptions about mangroves. Treated kids state that they prefer to have more mangroves near their community. We detect positive but not statistically significant changes in environmental behaviors (reduced littering, electricity conservation, etc.) and small but not statistically significant increases in their willingness to pay for goods associated with mangrove conservation. Our ability to detect differences in WTP is compromised by a small sample size. There is heterogeneity in treatment effects according to sex: girls are more likely to have significant increases in knowledge about mangroves, but boys have more positive changes in general environmental attitudes.

We also analyze treatment heterogeneity by the time elapsed between the intervention and the endline survey, as well as by age. Though not part of our initial design, the time elapsed between the training intervention and end-line surveys varied by club between eight and 21 months. We provide evidence that this delay was quasi-random. We do not find any significant variation in responses across this covariate, but believe that this relatively long-run stability of response is an important result given that there a large number of RCTs with a very short follow-up window, and that we hope that education has effects on children far beyond their school years.[2] We also do not detect variation in response by age, which does not support previous claims that there may be an optimal age range for environmental education interventions (Van De Wetering et al. 2022).

In order to assess spillover effects of the program, we estimated direct impacts on the parents of participating kids, and also indirect impacts on kids in treated communities who did not participate in the mangrove activity.We find evidence of spillovers across peers. In three of the four outcomes, the spillover-point estimates of peers in 75/25 clubs are positive. Furthermore, the estimated effect associated with the

[2]A working paper by Carpio & Ferraro (2024) compiles information on 250 RCTs published between 2010 and 2022. Among these, the median post-treatment study length was 1.3 months. Fewer than 1 in 5 studies had post treatment periods of over a year.

outcome that we find the strongest support for direct effects, a preference for mangroves, is marginally significant even when accounting for multiple hypothesis testing.

The data also show an influence of children on their parents. In particular, the parents of participating children are more likely to show improvements in their environmental behaviors and in their attitudes towards mangrove conservation. Women also show increases in their general environmental attitudes. Although the estimates are noisy, we also detect a qualitative increase in parents' willingness to pay for goods associated with mangrove conservation.

This work contributes to the literature on environmental education specifically and also the economics of education more broadly, both in high- and low-income settings. A recent meta-analysis of environmental education interventions targeted at children (Van De Wetering et al. 2022) reviewed 169 publications published between 1971 and 2019. Only 15% of these included measures of behavior, 22% measured impacts with any delay (ranging from 10 weeks to 5 years), only 3.7% were experimental, and 7 out of 169 were conducted in Latin American countries (4 of these in Brazil). In 97% of the studies reviewed, behaviors measured were self-reported. Our study includes measures of perceptions, attitudes, and behavior, measures impact a year after the intervention, uses a robust experimental design, and adds evidence for Latin America. Further, we use an incentivized experiment to measure willingness to pay for conservation-related goods, an observable rather than a self-reported metric of environmental value. Our experimental design also allows us to credibly estimate the causal impacts of the educational program.

A recent RCT on an environmental education program integrated into the Chilean school system is similar to ours in theme, and shows positive program impacts on students' knowledge, attitudes, and behaviors (Jaime et al. 2023). They find positive impacts on these outcomes for the students in their sample. Our study complements this one by examining a program outside of school (and therefore eliminating the issue of substitution of instructional time), focusing on a single environmental issue (mangroves), and measuring peer spillovers and willingness to pay.

We also contribute to the broader literature on the economics of education in developing countries, where there are many excellent studies using randomized controlled trials or other plausibly exogenous sources of variation. This work broadly demonstrates important effects on economic outcomes (such as wage and productivity growth, e.g., Peet et al. (2015)) and also outcomes like gender roles (Du et al. 2021), aspirations, religiosity (Mocan & Pogorelova 2017), and attitudes towards immigrants (Nunziata et al. 2016). In a variety of low-income settings, scholars have identified significant spillovers of educational interventions onto non-participants, including a higher propensity to enroll in and attend school (Bobonis & Finan 2009, Muralidharan & Prakash 2017) and be politically active (Wantchekon et al. 2015), among other outcomes. There is also a growing body of work on the transmission of information from children to their parents.

An early innovation in this space demonstrates that children in Peru passed on information on agricultural technology from videos at school to their parents, with a stronger communication flow between kids and parents of the same gender (Maruyama et al. 2012). Related work is currently ongoing in Uganda, where students were shown videos of practices to improve bean and banana production in schools. Early results show a clear dissemination path from kids to parents (Pietrelli et al. 2024). Other examples involve education about dengue and malaria prevention in schools, which show increases in parents' knowledge and use of protective measures up to 30 days after the intervention (Dsouza et al. 2021).

Literature on the spillover effects of environmental education is less common. An observational study in the Seychelles with small sample found that children participating in wildlife clubs with education on wetlands gained more knowledge than those in clubs who did not have the training, and that parents of these children also had higher knowledge scores (Damerell et al. 2013). However, in an experiment in North Carolina, scholars recently experimentally showed that an intervention designed to build climate change concern in adults via education of their middle school children can be effective (Lawson et al. 2019). The paper examining the environmental education curriculum introduced in Chile was designed to both induce and measure spillover effects onto parents (Jaime et al. 2023). While their measured direct effects are positive, as mentioned above, they find no change in the same measures for parents.

2 Details on program background and experimental design

The educational intervention analyzed here is part of a larger effort begun by an international conservation organization (Seacology) that was designed to increase awareness of mangroves' ecological role and stimulate conservation efforts. In 2021, as part of the Mangrove Initiative, Seacology partnered with Grupo Jaragua – a Dominican conservation organization – to implement the "Play for the Mangroves" project. The initiative combines conservation awareness with sports by having kids learn about mangrove conservation and participate in conservation activities while providing them with equipment for their sports leagues.

The educational session took place during a field trip to a local mangrove, where participants were presented information about mangroves, their importance, threats, and what can be done to protect them. After the informative session, participants perform an environmental activity such as reforestation, coastal or mangrove cleaning, bioblitz (biological surveying of species to record all the living species within a designated area), etc. The "teachers" of these workshops are themselves biologists, many of whom participate in conservation and research projects throughout the Dominican Republic. The presentation, questions, and activity last about 90 minutes, with additional time spent with the Seacology staff in transit to the mangroves and also often on the beach afterwards. The pedagogical approach combines cutting-edge understanding of ecology with the benefit of experiential learning through environmental activity. A significant amount of academic research underscores the importance of hands-on learning for student understanding, retention, and enthusiasm for the information that they are presented with (Beard & Wilson 2018).

This project is registered in the AEA RCT Registry under protocol number AEARCTR-0009420. Recruitment of clubs began in February 2022. Grupo Jaragua provided researchers with a list of almost 50 clubs they had reached out to as potential participants in our project. In addition to this, Innovations for Poverty Action (IPA) used geolocation data to identify sports clubs near our target zones to consider them as potential participants as well. IPA reached out to these sports clubs' coaches and collected some basic information to allow us to screen them to construct the sample. We only invited sports clubs that met the following conditions:

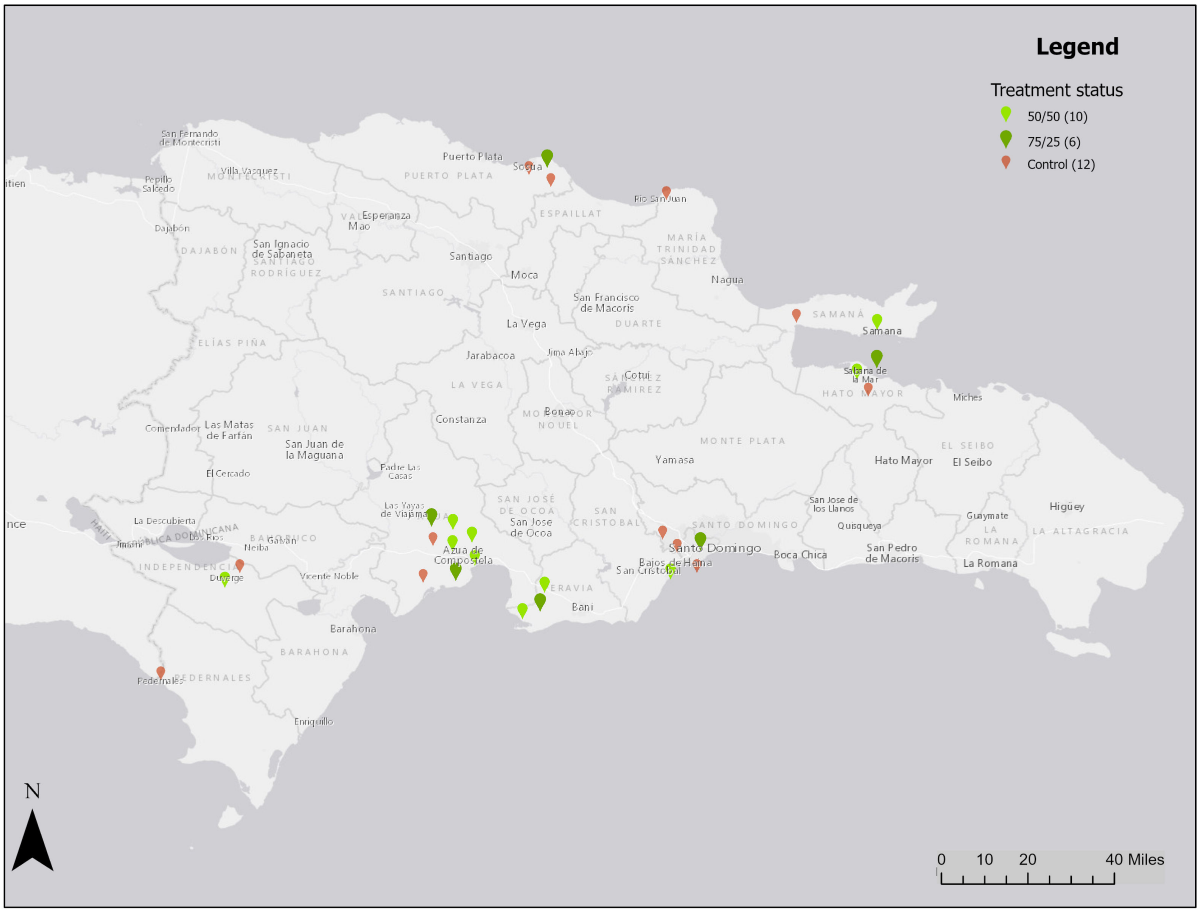
1. More than 30 regular members, where a regular member is a child who attends club activities at least once per week.
2. Play baseball, volleyball, or basketball.
3. Are located in a community in coastal provinces that have mangrove forests.

Although our goal was to examine 50 clubs, our final recruitment number was 32, from which 4 clubs (3 treatment and 1 control) attrited between baseline and endline. The main barrier to enrolling more clubs was difficulty in scheduling the intervention. We also endeavored to balance the sample of clubs between girls (volleyball and basketball) and boys (baseball), as heterogeneity of effects by gender is of primary interest. The final sample of analysis clubs is shown in Figure 1. We discuss attrition below.

The experiment was designed to examine spillovers from non-participants to participants and also from kids to parents. To this end, we had three arms: control (13 clubs), 50% treated (11 clubs) and 75% treated (9 clubs). In the 50% clubs, half of the kids participated in the mangrove workshop while the other half attended an art appreciation training (the "control training"), while in the other treatment arm 75 percent of kids participated in mangrove training and 25% in art appreciation. In the pure control clubs all of the kids participated in art appreciation rather than in mangrove training.

The baseline survey was conducted between June and September 2022. The training began in August 2022, but the rollout was slowed by logistical challenges, and some clubs received their first chance at training in May 2023. Follow-up training opportunities were offered in several municipalities where many kids missed the first workshop, which meant that there were some kids still receiving training into September of 2023. Funding delays pushed the start of the endline to February 2024, and data collection concluded in June of 2024. The delays in between the intervention and the endline surveys meant that some participants were surveyed 8 months after their training, while others were interviewed with 21 months between the training and the endline. Although heterogeneity in impact across "time since treatment" is not in our pre-analysis

Figure 1: Map of intervention clubs



Note: RCT clubs are indicated with markers within the district where they are located. Red markers are pure controls and green markers indicate different levels of treatment intensity. Appendix Figure A1 contains a map showing the initial pool of recruitment clubs. Markers are not precise.

plan, we do exploratory analysis of variation in impact by time since the workshop since this offers the opportunity to understand if impacts might dissipate over time. Tables A1 and A2 show that the variation in time since treatment is not correlated with observable characteristics.

Baseline and endline surveys contain modules intended to measure their career aspirations, attitudes about local and global environmental issues, attitudes towards mangroves, knowledge about mangroves' functions within the economy and the ecosystem, and general environmental behaviors. Questions on local and global environmental issues and behaviors were modified versions of questions that appeared in a 2015 survey on climate change attitudes implemented by the NORC Center for Public Affairs Research and Yale School of Forestry and Environmental Studies. We also sourced questions on environmentally-related behaviors from a 2012 national survey on environmental perceptions and attitudes implemented in Mexico by the Autonomous National University of Mexico. We designed our own questions to assess attitudes and knowledge about mangroves. These questions asked respondents if they preferred more mangroves nearby, why or why not, and also what functions they believe mangroves provide. These were relatively open-ended, and respondents indicated a wide variety of attitudes and knowledge which were then classified into narrower categories. In the baseline survey we collected basic demographic information, including main sources of household income and exposure to environmental risks.

The endline survey did not contain demographic or income questions but did contain a module assessing willingness to pay for honey. This is a revealed preference exercise that presented both kids and parents with the opportunity to purchase the honey at a randomly drawn price. The honey that we offered was produced in hives associated with mangroves and is marketed as a product that supports mangrove conservation. In the script for this module, we framed the honey as follows: "Remember that this honey we offer you is a special honey, which comes from the mangroves of Las Calderas and is produced by local beekeepers committed to the conservation of the mangroves. Each jar supports the care and conservation of our mangroves. Do you want to buy this 7oz jar of honey for RD$ [XXX] pesos?"

The intention of this exercise was to assess whether the intervention had changed participants' willingness to pay for mangrove conservation. Prices were randomly drawn from the sets 90, 100, 110, 120, 130 for kids and 90, 110, 130, 150, 170 for parents. We presented this opportunity to either the child or the adult in each participating household. At the time of the survey, the price for a 7oz bottle of honey in the grocery store was around 100 pesos. Participants paid for any purchases out of their show-up fee. Those who were not randomly selected to participate in the WTP experiment received an incentive of USD $3.33 (RD$200), whereas those selected received USD $6.76 (RD$400). Prior to conducting the honey sale, we did a similar exercise for notebooks. This was intended to offer participants a chance to become familiar with the format and also so that their purchase decision on the notebook could be included as a control in estimations for honey (Dizon-Ross & Jayachandran 2022). The baseline and endline survey instruments are available in a separate online appendix.

3 Descriptive statistics

In the baseline, we collected information from 1,533 individuals, including both parents and kids. Table 1 measures balance across the three different child groups. We report the means of each variable in the baseline, as well as the p-values associated with comparing the mean of each variable across control and the 50/50 teams, control and the 75/25 teams, and across the 50/50 and 75/25 teams. Very few of the differences in the means are statistically significant. We find differences in the "prefer beach to mangrove" and "turned off radio after listening." There are no statistical differences in the amount of time between the baseline and end-line surveys. Below, we test for heterogeneity in the treatment effects across this dimension, arguing that the variation is quasi-random. We repeat this exercise for the parents in table 2. Here, too, we find very few statistically significant differences.

Table 1: Baseline balance, kids

	Treatment status			p-values		
	Control	50/50	75/25	Control vs 50/50	Control vs 75/25	50/50 vs 75/25
	(1)	(2)	(3)	(4)	(5)	(6)
Female	0.61	0.64	0.48	0.90	0.59	0.53
Age	12.69	12.63	12.87	0.91	0.78	0.71
Currently enrolled	0.98	0.99	0.95	0.62	0.20	0.13
Prop. days attended last week	-5.36	-2.58	0.88	0.50	0.06*	0.19
Science favorite subject	0.11	0.10	0.16	0.85	0.23	0.23
Environmental attitude index	-0.12	-0.06	-0.24	0.62	0.49	0.33
Prefer fewer mangroves	0.48	0.53	0.56	0.37	0.13	0.59
Prefer beach to mangrove	0.58	0.67	0.70	0.04**	0.02**	0.50
Very concerned about DR environment	3.47	3.41	3.43	0.58	0.80	0.85
Very concerned about global environment	3.53	3.52	3.46	0.97	0.62	0.64
Very concerned about water contamination	3.15	3.31	3.04	0.07*	0.45	0.07*
Very concerned about plastics	0.19	0.15	0.13	0.41	0.09	0.38
Feel responsible for environmental protection	3.06	3.00	3.06	0.62	0.99	0.61
Knows what a mangrove is	0.34	0.40	0.28	0.47	0.46	0.16
Mangroves protect from erosion	0.08	0.05	0.03	0.24	0.06	0.29
Mangroves protect from hurricanes	0.02	0.01	0.01	0.28	0.30	0.92
Mangroves protect from climate change	0.07	0.04	0.06	0.11	0.64	0.39
Mangroves protect animals	0.11	0.17	0.16	0.14	0.32	0.79
Mangroves eliminate contaminants	0.04	0.04	0.05	0.88	0.47	0.67
Positive environmental behavior index	0.22	0.15	0.16	0.50	0.48	0.97
Littered in the past week	0.23	0.26	0.28	0.63	0.63	0.89
Turned off TV after watching	0.90	0.90	0.90	0.90	0.84	0.94
Turned off radio after listening	0.89	0.97	0.84	0.00***	0.04**	0.00***
Accepted plastic bag from colmado	0.81	0.85	0.87	0.41	0.09*	0.38
Time since treatment	16.04	14.36	14.95	0.17	0.36	0.64
Observations	264	223	127	.	.	.

The first three columns show the means of the listed variables. The p-values from a regression of the variable on an indicator for the relevant treatment group, with standard errors clustered at the level of the club.

Table 2: Baseline balance, parents

	Treatment status			p-values		
	Control	50/50	75/25	Control vs 50/50	Control vs 75/25	50/50 vs 75/25
	(1)	(2)	(3)	(4)	(5)	(6)
Age	38.84	39.76	41.74	0.52	0.09	0.20
Female	0.65	0.77	0.63	0.05**	0.79	0.11
Live in community	0.93	0.93	0.95	0.99	0.77	0.74
Number hh members	3.65	3.64	3.75	0.94	0.67	0.55
Live with spouse	0.93	0.97	0.95	0.66	0.74	0.87
Environmental risk index	1.98	1.76	1.57	0.48	0.07*	0.28
Simple asset index	0.59	0.58	0.60	0.94	0.85	0.81
University degree	0.28	0.35	0.37	0.29	0.47	0.85
Income: agriculture	0.13	0.30	0.15	0.04**	0.77	0.09*
Income: remittances	0.26	0.34	0.25	0.18	0.77	0.24
Income: govn't transfers	0.35	0.40	0.32	0.53	0.76	0.41
Income: other employment	0.56	0.49	0.54	0.10*	0.66	0.41
Income: small business	0.30	0.38	0.25	0.18	0.41	0.05**
Income: fishing	0.04	0.05	0.01	0.93	0.14	0.27
Income: rent	0.02	0.01	0.02	0.83	0.97	0.75
Environmental attitude index	0.10	-0.07	-0.14	0.11	0.36	0.78
Would prefer fewer mangroves	0.30	0.29	0.36	0.88	0.49	0.30
Would prefer a beach to mangroves	0.57	0.48	0.45	0.24	0.16	0.71
Very concerned about DR environment	3.64	3.50	3.38	0.05**	0.15	0.50
Very concerned about global environment	3.59	3.59	3.40	0.94	0.25	0.21
Very concerned about water contamination	3.12	3.01	2.96	0.61	0.61	0.88
Very concerned about plastic contamination	0.10	0.09	0.15	0.86	0.07*	0.12
Knows what mangroves are	0.69	0.70	0.57	0.94	0.26	0.21
Mangroves protect from erosion	0.08	0.11	0.10	0.44	0.71	0.72
Mangroves protect from hurricanes	0.09	0.06	0.10	0.25	0.85	0.28
Mangroves protect from climate change	0.33	0.28	0.30	0.08	0.59	0.67
Mangroves shelter animals	0.21	0.22	0.19	0.85	0.81	0.61
Mangroves eliminate contaminants	0.08	0.11	0.13	0.31	0.34	0.82
Positive environmental behavior index	0.17	0.08	0.18	0.50	0.87	0.45
Littered in past week	0.03	0.03	0.03	0.59	0.97	0.78
Turned off tv after watching	0.96	0.96	0.91	0.72	0.05**	0.08*
Turned off radio after listening	0.97	0.97	0.92	0.85	0.19	0.21
Accepted plastic bag from store	0.90	0.91	0.85	0.86	0.07*	0.12
Time since treatment	15.88	14.02	14.96	0.21	0.47	0.55
Observations	229	216	111	.	.	.

The first three columns show the means of the listed variables. The p-values from a regression of the variable on an indicator for the relevant treatment group, with standard errors clustered at the level of the club.

For some children and parents, we were not able to complete an end-line survey. Table A3 tests for differences in baseline survey responses across those where we have end-line results and those where we do not. The attrition appears to be uncorrelated with observables. There were 4 clubs that were surveyed in the baseline but did not participate in the endline. Of these, 3 were in a treatment arm and 1 in the pure control arm. Two of the clubs dropped out after being struck by Hurricane Fiona in September, 2022. Participant households were preoccupied with rebuilding and were not pressed to continue with the intervention after that. The two other attriting clubs were also affected by the hurricane – they had too few members afterwards to qualify for inclusion into the intervention.

4 Empirical approach

We apply the estimation process delineated in our pre-analysis plan (PAP). To assess the impact of the intervention, we estimate two basic equations. For the estimates of the direct effects of the intervention, we use all respondents in the control clubs, and only the treated respondents in the 50- and 75-percent treated clubs. The specification is:

$$y_{ict} = a + b \times T_{ict} + f_i + t_t + \varepsilon_{ict}, \tag{1}$$

where y_{ict} are the child and parent level outcomes; T_{ict} is the treatment status; f_i are the individual fixed effects; t_t is the time after treatment. We cluster standard errors at the level of the club, as specified in our plan. We also include randomization-inference clustered p-values, although this was not in our analysis plan.

To estimate spillover effects, our second specification uses the control arm and the untreated participants in the treatment clubs, with indicators for the intensity of club treatment. The specification is:

$$y_{ict} = a + b_1 \times Club_{T50/50_{ict}} + b_2 \times Club_{T75/25_{ict}} + f_i + t_t + \varepsilon_{ict}, \tag{2}$$

where $Club_{T50/50_{ict}}$ indicates an untreated participant in a club where 50% of kids attended mangrove training and $Club_{T75/25_{ict}}$ for individuals from clubs where 75% of kids were treated. We present an alternative specification which pools the spillover sample with the main treatment sample using indicators for different levels of treatment intensity in Tables B5-C8.

We pre-specified heterogeneity analysis by gender and by exposure to environmental risks. However, as mentioned above, we conduct exploratory analysis to examine whether treatment effects varied with the time elapsed between training and the endline survey and also, following on the environmental education literature, whether treatment effects varied by the age of the child.

We focus our analysis on three indices that measure environmental knowledge, attitudes, and behaviors, as well as the question regarding preferring more mangroves. To generate the environmental knowledge index, we generate the standardized sum of variables indicating whether a respondent named different classes of environmental services when asked what function mangroves have. The classes included services associated with climate change (e.g., hurricane protection), with consumption (e.g., for leisure activities), and with biodiversity (e.g., protection of plants or animals). To create the general environmental attitudes index, we generate the standardized sum of the responses to questions measuring their level of concern with the global environment, the environment in the D.R., with water contamination, and with solid waste contamination. We also included a question to try to assess free-riding[3]. In addition to the question regarding whether participants preferred more mangroves near them, there were complementary questions on attitudes towards mangroves that include the first thing they think of when they think of mangroves, and whether they prefer mangroves over the beach. Finally, to construct the environmental behaviors index, we first sum responses to whether they had littered, turned off the TV after watching, turned off the radio after listening, or accepted a plastic bag at the store, all within the past week. Because not all respondents had done all of the associated activities in the previous week, before standardizing, we divided the sum of the responses by the number of non-missing variables.

5 Results

5.1 Kids

Table 3 summarizes the key treatment effects results for children across the three knowledge, attitudes, and behavior indices, as well as the question regarding preferring more mangroves. The first panel of the table reports a single treatment effect estimate, while the remaining panels test for heterogeneous treatment effects across several dimensions. We report both clustered standard errors (in parentheses) and randomization inference p-values [in brackets]. Both are clustered at the level of the club. The code to produce the p-values is based upon Young (2019).

For the single-treatment effect estimates, we find point estimates that are consistent with the treatment improving environmental knowledge, attitudes, and behavior, as well as increasing the likelihood that the child prefers more mangroves to beaches. The point estimates for the knowledge index and preference for mangroves are also economically meaningful, with the treatment for the latter increasing over 0.2 standard deviations. The preference for mangrove is a binary responses, so the marginal effect should be interpreted as a 21 percentage point increase. Only this effect is precisely estimated, however. The Westfall-Young test for zero effect of the intervention across all outcomes is 0.013, rejecting that the experiment had no impact

[3]Do you agree with the statement: “If your neighbors do not protect the environment, you will not protect the environment either.”

(Young 2019).

There is some evidence that the knowledge and attitude treatment effects differ across boys and girls. Interestingly, however, the direction of heterogeneity varies across outcomes. The results suggest that girls gain more knowledge from the treatment, compared to boys, but that their environmental attitudes did not change or became slightly worse (net effect for attitudes: $0.167 - 0.250 = -0.083$). It is interesting to note, however, that in the baseline, boys had higher outcomes on the knowledge index. The net effect of the intervention on girls is to bring them, on average, much closer to the measured knowledge level of boys.[4]

It is noteworthy that there is no systematic degeneration of effects across the time since the intervention. This suggests that even a short experiential education opportunity can leave a long-lasting imprint. Similarly, there does not appear to be any systematic relationship between a child's age and the impact of the training.

We find some, albeit inconclusive, evidence of spillovers. In three of the four outcomes, the spillover-point estimates of peers in 75/25 clubs are positive. The estimated effect associated with a preference for mangroves is marginally significant even when accounting for multiple hypothesis testing.

In Appendix B, we report the disaggregated results within each index. Consistent with Table 3, we find the strongest impacts of the treatment on mangrove attitudes. The treatment increases the probability that a child wants more mangroves by 0.208 standard deviations. This effect is statistically significant using conventional standard errors or correcting for multiple hypothesis testing. The point estimate also suggests that the probability a child prefers a mangrove to a beach increases by 0.114 standard deviations, but p-values for this effect are just above 0.10. A child's first thought that comes to mind when thinking about mangroves shifts from being negative and about tourism to being nature-based. We find a reduction of 0.110 standard deviations in the probability the first thought is negative (this is significant at the 0.10 using both standard errors), a reduction of 0.0351 standard deviations in the probability the first thought is about tourism (significant at the 0.05 level), and an increase of 0.151 standard deviations that the first thought is about nature (significant at the 0.05 level). We find very little evidence that the treatment effects vary by gender, age, or time since treatment.

The evidence of spillovers also mirrors our main results. We find some evidence that non-treated peers in the 75/25 clubs want more mangroves; this effect is significant at the 0.10 level using both test statistics. These non-treated peers do not appear to have a greater preference for mangroves over beaches. We do not find strong evidence the treatment affected the other categories except for a reduction in littering.

[4]The total marginal effect for girls is $-0.0924 + 0.558 = 0.466$, but their baseline mean was -0.19. Adding this to the marginal effect yields 0.276, slightly higher than the boy's baseline knowledge index of 0.16.

Table 3: Workshop impacts kids' aggregated outcomes

	Knowledge index (1)	Environmental attitudes index (2)	Prefer more mangroves (3)	Behavior index (4)
Treated	0.177	0.0271	0.208***	0.0335
	(0.137)	(0.0705)	(0.0588)	(0.0313)
	[0.223]	[0.719]	[0.00332]	[0.307]
Treated	-0.0947	0.167	0.238**	0.0378
	(0.139)	(0.0810)	(0.0862)	(0.0365)
	[0.766]	[0.109]	[0.0220]	[0.307]
Treated × Female	0.488**	-0.250***	-0.0550	-0.00767
	(0.105)	(0.0778)	(0.0860)	(0.0363)
	[0.0204]	[0.00978]	[0.436]	[0.842]
Treated	0.493	-0.159	-0.377	0.0535
	(0.435)	(0.268)	(0.246)	(0.0980)
	[0.199]	[0.588]	[0.543]	[0.450]
Treated × Time since treated	-0.0218	0.0129	0.0394	-0.00138
	(0.0321)	(0.0182)	(0.0163)	(0.00717)
	[0.394]	[0.493]	[0.164]	[0.847]
Treated	-1.325	0.907	0.0583	0.0524
	(0.523)	(0.412)	(0.322)	(0.119)
	[0.320]	[0.536]	[0.810]	[0.567]
Treated × Age	0.117	-0.0687	0.0121	-0.00147
	(0.0431)	(0.0313)	(0.0239)	(0.00912)
	[0.147]	[0.564]	[0.475]	[0.815]
Mean baseline boys	0.170	-0.410	0.550	0.620
Mean baseline girls	-0.190	0.070	0.450	0.650
Observations	931	929	778	931
Control 50/50	0.0813	-0.0597	-0.0371	0.0179
	(0.154)	(0.0995)	(0.0542)	(0.0388)
	[0.602]	[0.583]	[0.533]	[0.701]
Control 75/25	0.244	0.236	0.167	-0.0136
	(0.262)	(0.212)	(0.0821)*	(0.0409)
	[0.384]	[0.320]	[0.0976]	[0.808]
Observations	824	820	692	824
P-val joint test	0.620	0.410	0.060	0.790
Mean baseline	-0.030	-0.130	0.500	0.650
Observations	824	820	692	824

Table shows results from a series of difference in difference regressions for the baseline and endline child surveys. Each panel is a separate regression. Also included in each specification, but not shown, is a post variable. Standard errors are clustered at the level of the club and shown in (). The knowledge index is comprised of indicators of knowledge about mangrove functions, column (3) indicates that a respondent prefers to have more mangroves near their community, the behavior index is an index aggregating positive environmental behaviors. Each index is standardized. Effect estimations exclude controls from treated clubs. The Westfall-Young test of any effect of the experiment across all columns in the top panel is 0.013 , and for spillovers, is 0.533 . The p-value listed in the table footer is the p-value for an F-test that both of the indicators on the spillover effects are equal to zero. *** $p < 0.01$, ** $p<0.05$, * $p< 0.10$ based upon the randomization inference p-values.

Table 4 shows the estimated median WTP for the kids who participated in the honey auction. This is calculated using separate regressions for subgroups, conditioning on gender, age, time since treatment, behavior in the notebook auction, and an asset index calculated from the baseline demographic characteristics of the parents. We use the log-transformed price, so the probability of a yes response is:

$$Pr(y_i) = Pr(B_i \leq WTP)$$
$$= Pr(ln(B_i)) \leq X_i\beta + \varepsilon_i$$
$$= Pr(\varepsilon_i \geq ln(B_i) - X_i\beta),$$

where y_i is equal to 1 if the response is yes, B_i is the random payment offer, X_i are covariates and ε_i are unobservables. To estimate the parameters, we normalize by the standard deviation of ε_i:

$$Pr(yes) = Pr(\frac{\varepsilon}{\sigma} \geq \frac{1}{\sigma}lnB - X\frac{\beta}{\sigma})$$
$$= Pr(\varepsilon^* \geq \gamma lnB + X\theta),$$

where $\varepsilon^* \sim N(0,1)$, $\gamma = 1/\sigma$, and $\theta = -\beta\gamma$. We calculate the median WTP by evaluating the equation at the mean values of the X observed characteristics ($WTP = exp(-\frac{\overline{X}\theta}{\gamma})$). We test whether or not the estimated WTP is significantly different from zero, indicated by the stars in the table.

We find that in the sample that combines boys and girls, there is a slightly higher willingness to pay in the treatment group than in the controls (about 3 percent). Among just boys, this difference increases to 13 percent. These two estimates are not statistically different from each other. For girls, there is a difference between treatment and control of more than 250 pesos (more than any of the offer prices), but there is so much noise in the responses that these estimates are not distinguishable from zero or from each other.

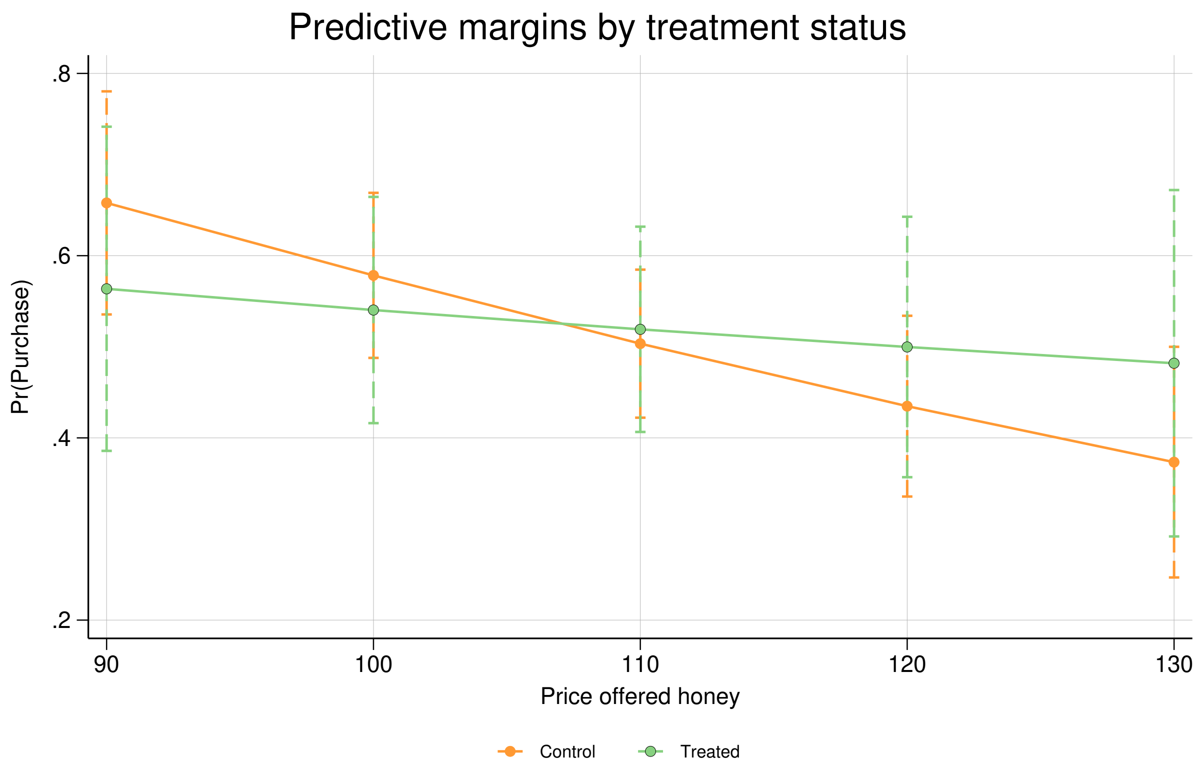
Figures 4 and 5 plot out the predictive margins by treatment status condition on the controls. Here we observe that treated kids exhibit qualitatively less sensitivity to price. The data also show that the boys' demand curve for honey shifts upward at every price (although the differences are not significant), while girls do not respond at all to price and generally purchase less honey.

Table 4: Estimated median WTP for kids according to treatment arm

	Control (1)	Treatment (2)
Combined sample		
WTP	111.553***	118.877***
	(5.865)	(38.747)
Observations	172	94
Boys		
WTP	111.088***	120.190***
	(5.311)	(12.028)
Observations	63	45
Girls		
WTP	4.644***	263.632
	(0.178)	(2719.921)
Observations	109	49

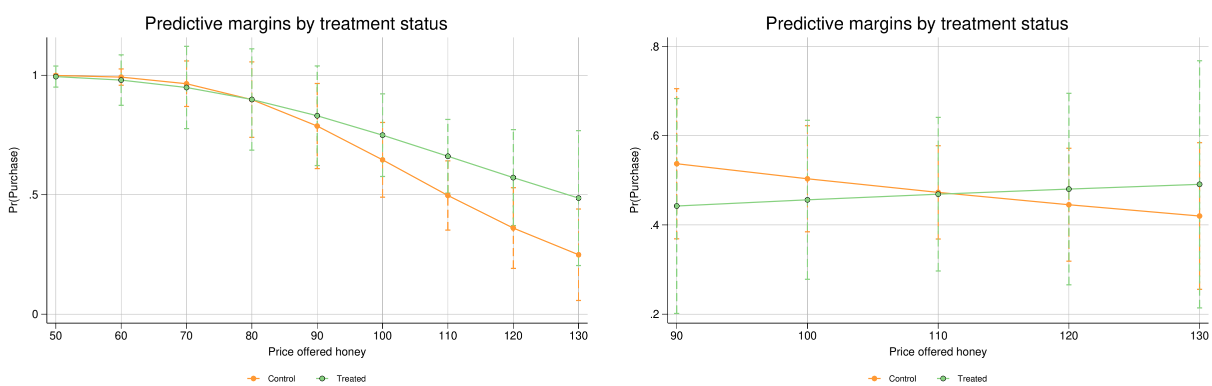
Each cell shows the median WTP for the group estimated from subgroup probit regressions that include as controls gender, age, time since treatment, and the asset index. We exclude spillover kids from the sample. *** p < 0.01, ** p<0.05, * p< 0.10 indicate the results from a test that the estimate is different from zero.

Figure 2: Estimated honey purchases, kids



Estimated impacts using a probit regression with interactions between treatment and the prices offered to kids. Controls include if the child was in the spillover sample, gender, age, asset index, outcome from notebook experiment, and time since the intervention. Standard errors clustered at the level of the club. Dashed lines are 95% CIs.

Figure 3: Estimated honey purchases, kids, by sex



(a) Boys

(b) Girls

Estimated impacts using a probit regression with interactions between treatment and the prices offered to kids. Controls include if the child was in the spillovers sample, gender, age, asset index, outcome from notebook experiment, and time since the intervention. Standard errors clustered at the level of the club. Dashed lines are 95% CIs.

5.2 Parents

The aggregated results across all outcomes for parents are contained in Table 5. The homogenous treatment effects show no impact on knowledge or general environmental attitudes. We find improvements in attitudes towards mangroves (as measured by the parents' rankings of hypothetical government investments including mangrove conservation) and in environmental behaviors, however. While it is not the same question as with the children, the parents' treatment effect on where they rank a mangrove project is larger than the children's treatment effect associated with whether they would prefer more mangroves. Similarly, the parents' treatment effect associated with the behavior index is larger than the children's. These results suggest meaningful spillovers from children to parents.

We find heterogeneity in the environmental-attitudes treatment effect—women appear to have had larger and statistically significant changes in their general environmental attitudes. This impact is particularly large relative to their baseline measure: the marginal effect for women is $-0.104 + 0.358 = 0.254$, a quarter of a standard deviation. Finally, the probability of the experiment having had zero impact on parents' outcomes, measured by the Westfall-Young statistic, is marginally significant with a p-value of 0.071.

We report disaggregated results within each index in Appendix C.

Table 5: Workshop impacts parents' aggregated outcomes

	Knowledge index (1)	Environmental attitudes index (2)	Rank mangrove project (3)	Behavior index (4)
Treated	-0.0675	0.143	0.374**	0.0528**
	(0.181)	(0.0915)	(0.147)	(0.0209)
	[0.721]	[0.113]	[0.0203]	[0.0248]
Treated	-0.127	-0.0741	0.449*	0.0648**
	(0.246)	(0.0791)	(0.216)	(0.0280)
	[0.625]	[0.393]	[0.0949]	[0.0300]
Treated × Female	0.139	0.309**	-0.122	-0.0198
	(0.218)	(0.0860)	(0.236)	(0.0240)
	[0.613]	[0.0188]	[0.885]	[0.266]
Treated	-0.616	0.0349	0.951	0.0747
	(0.863)	(0.444)	(0.634)	(0.0477)
	[0.434]	[0.947]	[0.142]	[0.241]
Treated × Time since treated	0.0378	0.00741	-0.0392	-0.00150
	(0.0613)	(0.0332)	(0.0442)	(0.00341)
	[0.554]	[0.814]	[0.314]	[0.802]
Treated	-0.0499	0.143*	0.383**	0.0518**
	(0.181)	(0.0915)	(0.146)	(0.0205)
	[0.747]	[0.0992]	[0.0170]	[0.0260]
Treated × environmental risk	0.129	-0.00653	0.145	-0.0124
	(0.120)	(0.0722)	(0.106)	(0.0172)
	[0.972]	[0.116]	[0.165]	[0.971]
Mean baseline men	0.210	0.210	2.840	0.730
Mean baseline women	-0.160	-0.070	2.380	0.700
Observations	520	813	759	813

Table shows results from a series of difference in difference regressions for the baseline and endline parent surveys. Each panel is a separate regression. Also included in each specification, but not shown, is a post variable. Standard errors are clustered at the level of the club and shown in (). The knowledge index is comprised of indicators of knowledge about mangrove functions, the rank of mangrove project is the parents ranking of a project investing in mangroves among lighting, roads, and community parks projects (higher numbers imply better ranking), the behavior index is an index aggregating positive environmental behaviors. Each index is standardized. Effect estimations exclude controls from treated clubs. The Westfall-Young test of any effect of the experiment across all columns in the first panel is 0.074 . *** $p < 0.01$, ** $p<0.05$, * $p< 0.10$ based upon the randomization inference p-values.

The results of the honey auction are noisy for the parent sample. In the combined sample, the WTP is statistically different from zero for the treatment group, but large and noisy for the control group. The outcomes for men in general are noisy, though larger for treatment than for control. The difference in WTP for women in the treatment versus the control group is about 6 percent, but this difference is not large enough to be statistically significant given the sample size.

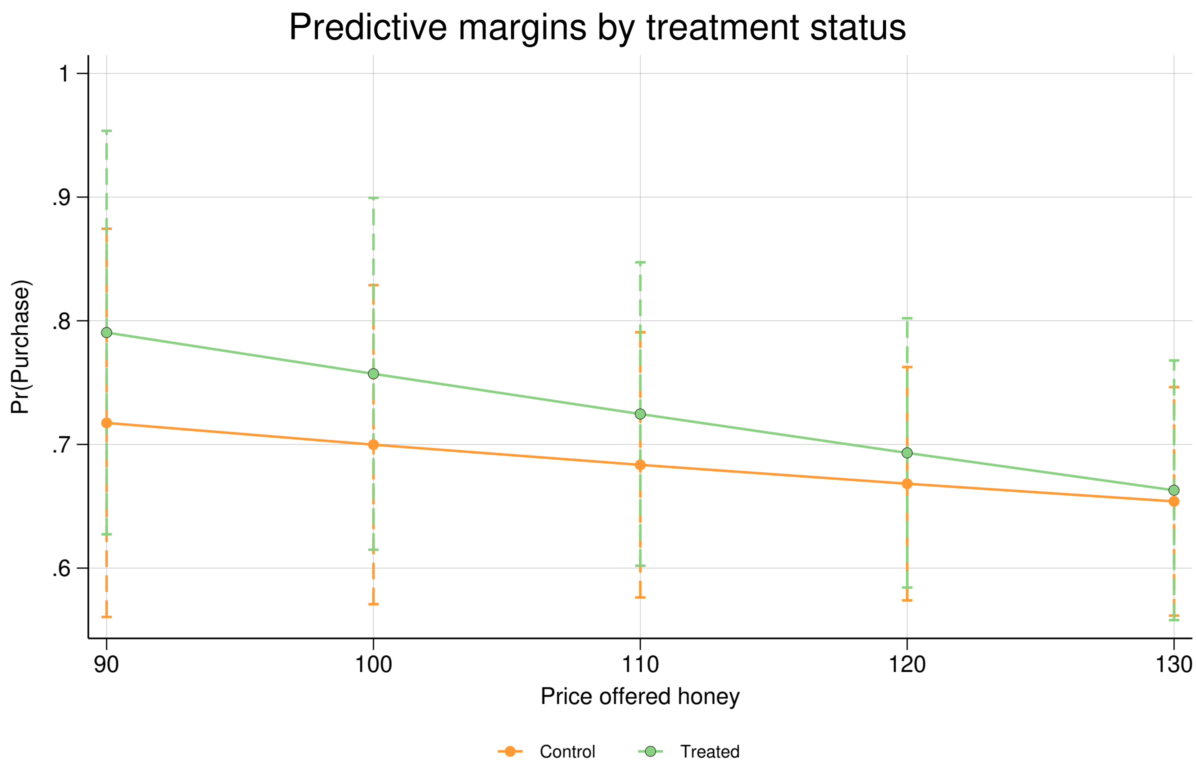
Table 6: Estimated median WTP for adults according to treatment arm

	Control (1)	Treatment (2)
Combined sample		
WTP	462.541	189.611***
	(1142.042)	(51.308)
Observations	116	88
Men		
WTP	55.869	374.179
	(65.868)	(3566.824)
Observations	42	27
Women		
WTP	164.954***	175.905***
	(35.136)	(36.783)
Observations	74	61

Each cell shows the median WTP for the group estimated from subgroup probit regressions that include as controls gender, age, time since treatment, and the asset index. We exclude spillover kids from the sample. *** p < 0.01, ** p<0.05, * p< 0.10 indicate the results from a test that the estimate is different from zero.

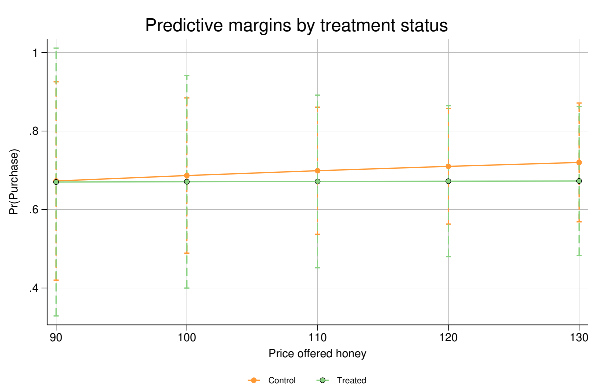
The conditional predictive margins by treatment status are generally higher at all price offers (Figure 4). Men exhibit no price response at all, in either treatment or control groups. Women buy less honey at higher prices, and in the treatment group, they are slightly more likely to do so at any price, but confidence intervals between the treatment and control groups overlap.

Figure 4: Estimated honey purchases, adults

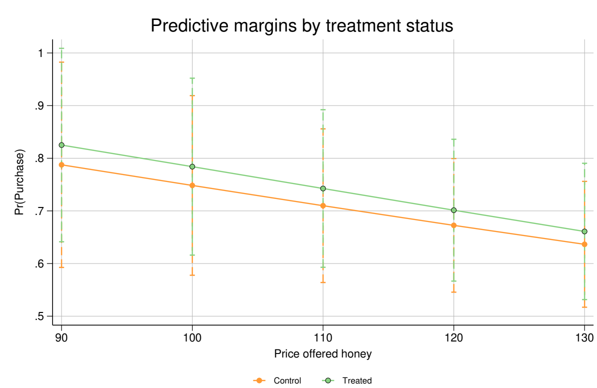


Estimated impacts using a logit regression with interactions between treatment and the prices offered to adults. Controls include gender, age, asset index outcome from notebook experiment, and month of survey. Standard errors clustered at the level of the club. Dashed lines are 95% CIs.

Figure 5: Estimated honey purchases, adults, by sex



(a) Men



(b) Women

Estimated impacts using a logit regression with interactions between treatment and the prices offered to adults. Controls include gender, age, asset index outcome from notebook experiment, and month of survey. Standard errors clustered at the level of the club. Dashed lines are 95% CIs.

6 Conclusion

Mangroves provide critical ecosystem services, yet their coverage continues to decline at an alarming rate. We use a randomized controlled trial to evaluate an environmental education program in the Dominican Republic across sports club participants. We test for effects on children's knowledge, attitudes, behaviors, and willingness to pay (WTP) for conservation-related goods, as well as spillover effects on peers and parents.

The intervention demonstrated statistically significant impacts on children, even after accounting for multiple hypothesis testing, with improvements in environmental attitudes and knowledge about mangroves. Importantly, we do not find any evidence of waning treatment effects despite observing endline outcomes as far out as 21 months after treatment. Finally, for children, we find that changes in behaviors and WTP were modest and not statistically significant.

We observe weak evidence of spillovers on attitudes from treated children to their untreated peers, suggesting some peer-to-peer transmission of the program's effects. In contrast, we find stronger evidence of spillovers from children to parents, particularly in terms of environmental attitudes and behaviors.

These findings suggest that while environmental education can effectively enhance children's awareness and attitudes, achieving broader behavioral changes and peer spillovers may require more intensive or sustained interventions. The evidence of intergenerational transmission highlights the potential for family-focused approaches to amplify the impact of such programs.

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Online Appendix

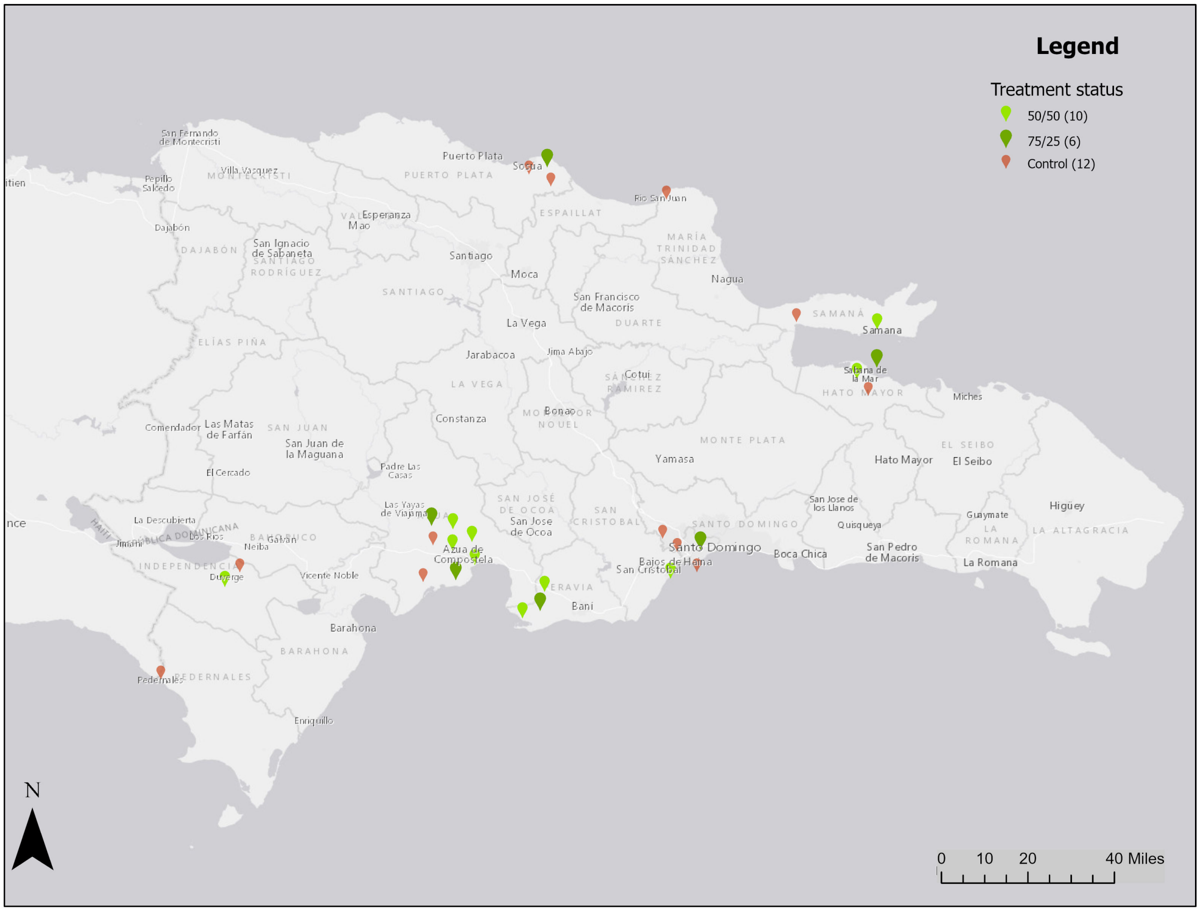
Growing Awareness: Evaluating the Impact of Environmental Education on Attitudes, Knowledge, and Behavior

Jennifer Alix-García and Christopher R. Knittel

Table of Contents

A Baseline statistics

Figure A1: Map of recruitment clubs



Note: The pool of recruitment clubs are indicated with markers within the district where there are located. clubs are indicated with markers. Red markers were not recruited and green markers are the sample used in the intervention. Club markers are not precise.

Table A1: Baseline balance, kids, time since treatment terciles

	Time since treatment			p-values		
	Tercile 1	Tercile 2	Tercile 3	Tercile 1 vs Tercile 2	Tercile 1 vs Tercile 3	Tercile 2 vs Tercile 3
	(1)	(2)	(3)	(4)	(5)	(6)
Female	0.58	0.62	0.58	0.89	0.80	0.91
Age	12.34	12.77	13.07	0.18	0.80	0.30
Currently enrolled	0.99	0.99	0.95	0.27	0.06	0.01
Prop. days attended last week	-2.95	-5.85	-0.37	0.95	0.24	0.13
Science favorite subject	0.14	0.09	0.11	0.18	0.09	0.94
Environmental attitude index	-0.13	-0.12	-0.12	0.90	0.95	0.93
Prefer fewer mangroves	0.48	0.52	0.55	0.24	0.75	0.40
Prefer beach to mangrove	0.67	0.62	0.61	0.17	0.59	0.36
Very concerned about DR environment	3.45	3.36	3.52	0.85	0.21	0.22
Very concerned about global environment	3.53	3.47	3.54	0.70	0.37	0.64
Very concerned about water contamination	3.17	3.24	3.14	0.80	0.41	0.48
Very concerned about plastics	0.17	0.19	0.11	0.57	0.18	0.03
Feel responsible for environmental protection	3.07	2.97	3.09	0.64	0.23	0.33
Knows what a mangrove is	0.37	0.33	0.35	0.64	0.59	0.96
Mangroves protect from erosion	0.07	0.06	0.05	0.53	0.95	0.51
Mangroves protect from hurricanes	0.02	0.00	0.02	0.56	0.11	0.52
Mangroves protect from climate change	0.04	0.07	0.05	0.34	0.22	0.63
Mangroves protect animals	0.11	0.16	0.16	0.16	0.56	0.57
Mangroves eliminate contaminants	0.05	0.04	0.03	0.59	0.68	0.25
Positive environmental behavior index	0.21	0.21	0.12	0.58	0.54	0.19
Littered in the past week	0.26	0.27	0.23	0.93	0.64	0.45
Turned off TV after watching	0.90	0.91	0.88	0.80	0.49	0.32
Turned off radio after listening	0.91	0.91	0.90	0.96	0.71	0.59
Accepted plastic bag from colmado	0.83	0.81	0.89	0.57	0.18	0.03
Observations	212.00	224.00	173.00	.	.	.

The first three columns show the means of the listed variables. The p-values from a regression of the variable on an indicator for the relevant time since treatment tercile, with standard errors clustered at the level of the club.

Table A2: Baseline balance, parents, time since treatment terciles

	Time since treatment			p-values		
	Tercile 1	Tercile 2	Tercile 3	Tercile 1 vs Tercile 2	Tercile 1 vs Tercile 3	Tercile 2 vs Tercile 3
	(1)	(2)	(3)	(4)	(5)	(6)
Age	41.30	37.83	40.31	0.04	0.01	0.57
Female	0.66	0.69	0.73	0.48	0.92	0.38
Live in community	0.89	0.97	0.95	0.01	0.03	0.35
Number hh members	3.72	3.68	3.57	0.64	0.89	0.40
Live with spouse	1.00	0.94	0.89	0.15	0.80	0.17
Environmental risk index	1.69	2.05	1.66	0.30	0.04	0.20
Simple asset index	0.60	0.58	0.58	0.22	0.62	0.35
University degree	0.38	0.33	0.25	0.14	0.92	0.10
Income: agriculture	0.22	0.22	0.14	0.57	0.54	0.15
Income: remittances	0.28	0.27	0.33	0.67	0.51	0.29
Income: govn't transfers	0.31	0.45	0.31	0.20	0.04	0.32
Income: other employment	0.51	0.56	0.51	0.43	0.20	0.67
Income: small business	0.35	0.27	0.33	0.33	0.14	0.71
Income: fishing	0.03	0.05	0.04	0.46	0.50	0.91
Income: rent	0.01	0.02	0.02	0.86	0.85	0.74
Environmental attitude index	-0.02	0.09	-0.14	0.89	0.13	0.30
Would prefer fewer mangroves	0.25	0.34	0.35	0.10	0.43	0.36
Would prefer a beach to mangroves	0.43	0.60	0.50	0.05	0.02	0.80
Very concerned about DR environment	3.56	3.55	3.48	0.59	0.75	0.53
Very concerned about global environment	3.62	3.52	3.52	0.23	0.51	0.72
Very concerned about water contamination	3.01	3.30	2.76	0.72	0.02	0.10
Very concerned about plastic contamination	0.13	0.08	0.11	0.37	0.24	0.77
Knows what mangroves are	0.69	0.70	0.60	0.62	0.53	0.17
Mangroves protect from erosion	0.12	0.09	0.06	0.19	0.96	0.15
Mangroves protect from hurricanes	0.07	0.10	0.05	0.78	0.23	0.30
Mangroves protect from climate change	0.31	0.28	0.34	0.80	0.37	0.45
Mangroves shelter animals	0.22	0.26	0.12	0.67	0.18	0.02
Mangroves eliminate contaminants	0.09	0.09	0.14	0.56	0.54	0.18
Positive environmental behavior index	0.13	0.10	0.19	0.81	0.58	0.27
Littered in past week	0.03	0.02	0.04	0.93	0.33	0.27
Turned off tv after watching	0.94	0.94	0.97	0.61	0.65	0.19
Turned off radio after listening	0.95	0.95	0.99	0.36	0.63	0.03
Accepted plastic bag from store	0.87	0.92	0.89	0.37	0.24	0.77
Observations	199.00	196.00	148.00	.	.	.

The first three columns show the means of the listed variables. The p-values from a regression of the variable on an indicator for the relevant time since treatment tercile, with standard errors clustered at the level of the club.

Table A3: Attrition, kids baseline responses

	Treatment status		p-value
	Non-attrited	Attrited	difference
	(1)	(2)	(3)
Female	0.60	0.54	0.43
Age	12.71	12.42	0.10
Currently enrolled	0.98	0.98	0.51
Prop. days attended last week	0.84	0.88	0.36
Science favorite subject	0.11	0.11	0.88
Environmental attitude index	2.48	2.42	0.68
Prefer fewer mangroves	0.51	0.47	0.38
Prefer beach to mangrove	0.63	0.64	0.92
Very concerned about DR environment	0.68	0.68	0.85
Very concerned about global environment	0.70	0.70	0.98
Very concerned about water contamination	0.55	0.49	0.33
Very concerned about plastics	0.46	0.46	0.99
Feel responsible for environmental protection	0.08	0.08	0.97
Knows what a mangrove is	0.35	0.36	0.76
Mangroves protect from erosion	0.06	0.04	0.24
Mangroves protect from hurricanes	0.01	0.02	0.80
Mangroves protect from climate change	0.05	0.10	0.05
Mangroves protect animals	0.14	0.13	0.45
Mangroves eliminate contaminants	0.04	0.04	0.99
Positive environmental behavior index	2.73	2.74	0.96
Littered in the past week	0.25	0.27	0.72
Turned off TV after watching	0.90	0.91	0.87
Turned off radio after listening	0.91	0.92	0.75
Accepted plastic bag from colmado	0.84	0.83	0.86
Club treated	0.57	0.65	0.25
In 50% treatment	0.36	0.42	0.49
In 75% treatment	0.21	0.23	0.69
Observations	614.00	173.00	.

The first two columns show the means of the listed variables. The third column displays the p-value from a regression of the variable on an indicator for attrition, with standard errors clustered at the level of the club.

B Disaggregated tables – kids

Table B1: Workshop impacts on kids' knowledge

	Knows what mangroves are (1)	Climate services (2)	Biodiv. services (3)	Consumptive services (4)	Knowledge index (5)
Treated	0.0811	0.0713	-0.0293	0.0708	0.177
	(0.0790)	(0.0429)	(0.0465)	(0.0584)	(0.137)
	[0.331]	[0.115]	[0.546]	[0.271]	[0.223]
Treated	-0.0569	0.00404	-0.0605	-0.00379	-0.0947
	(0.0776)	(0.0462)	(0.0748)	(0.0773)	(0.139)
	[0.915]	[0.811]	[0.160]	[0.922]	[0.911]
Treated × Female	0.249	0.121*	0.0559	0.134	0.488**
	(0.0939)	(0.0468)	(0.0835)	(0.0668)	(0.105)
	[0.854]	[0.0550]	[0.435]	[0.449]	[0.0164]
Treated	0.139	0.356	0.207	-0.249	0.493
	(0.185)	(0.197)	(0.256)	(0.231)	(0.435)
	[0.470]	[0.241]	[0.646]	[0.751]	[0.198]
Treated × Time since treated	-0.00396	-0.0196	-0.0163	0.0221	-0.0218
	(0.0117)	(0.0130)	(0.0179)	(0.0165)	(0.0321)
	[0.725]	[0.378]	[0.601]	[0.558]	[0.394]
Treated	0.448**	-0.329*	-0.0995	-0.414	-1.325
	(0.247)	(0.187)	(0.183)	(0.248)	(0.523)
	[0.0340]	[0.0583]	[0.459]	[0.869]	[0.319]
Treated × Age	-0.0287*	0.0313**	0.00548	0.0379	0.117
	(0.0202)	(0.0156)	(0.0133)	(0.0195)	(0.0431)
	[0.0734]	[0.0388]	[0.574]	[0.727]	[0.147]
Mean baseline boys	0.440	0.180	0.230	0.320	0.170
Mean baseline girls	0.270	0.170	0.120	0.210	-0.190
Observations	930	931	931	931	931
Control 50/50	-0.00264	0.0613	-0.0492	0.0397	0.0813
	(0.0646)	(0.0454)	(0.0577)	(0.0646)	(0.154)
	[0.965]	[0.203]	[0.406]	[0.559]	[0.602]
Control 75/25	0.0303	0.0265	-0.140	0.269**	0.244
	(0.0834)	(0.134)	(0.0995)	(0.0972)	(0.262)
	[0.766]	[0.833]	[0.190]	[0.0244]	[0.384]
P-val joint test	0.910	0.410	0.300	0.030	0.620
Mean baseline	0.360	0.190	0.140	0.260	-0.030
Observations	824	824	824	824	824

Table shows results from fixed effects OLS estimation. Fixed effects are at the child level, and regressions include a post variable (not shown). Standard errors are clustered at the level of the club and shown in (). Randomization inference p-values from 1,000 draws in []. Each of the service types is an indicator that a child mentioned and environmanl service in the category. The knowledge index is the total count across all of these, standardized. Direct treatment effect estimations (top 4 panels) exclude controls from treated clubs. The p-value for the Westfall-Young test of any effect of the experiment across all columns in the first panel is 0.403 , and for spillovers, is 0.191 . The last panel includes only controls, with indicators for post-treatment in 50% or 75% saturation clubs. The p-value listed in the table footer is the p-value for an F-test that both of the indicators on the spillover effects are equal to zero. *** $p < 0.01$, ** $p<0.05$, * $p< 0.10$ based upon the randomization inference p-values.

Table B2: Workshop impacts on kids' environmental attitudes

	D.R. env. worries (1-4) (1)	Global env worries (1-4) (2)	Concern water (0-4) (3)	Concern waste (0-4) (4)	Free riding 0/1 (5)	Concern index z score (6)
Treated	0.112	0.112	-0.0123	-0.0226	-0.0247	0.0271
	(0.0764)	(0.0764)	(0.118)	(0.124)	(0.0706)	(0.0705)
	[0.169]	[0.169]	[0.915]	[0.849]	[0.750]	[0.719]
Treated	0.200	0.0435	0.177	0.109	-0.00999	0.167
	(0.130)	(0.147)	(0.151)	(0.205)	(0.101)	(0.0810)
	[0.233]	[0.787]	[0.193]	[0.587]	[0.934]	[0.109]
Treated × Female	-0.158	-0.0181	-0.338**	-0.235	-0.0263	-0.250***
	(0.132)	(0.157)	(0.182)	(0.214)	(0.0993)	(0.0778)
	[0.591]	[0.944]	[0.0277]	[0.182]	[0.812]	[0.00945]
Treated	0.793*	0.254	-0.645	-0.449	-0.444**	-0.159
	(0.415)	(0.257)	(0.366)	(0.455)	(0.232)	(0.268)
	[0.0699]	[0.239]	[0.210]	[0.562]	[0.0383]	[0.588]
Treated × Time since treated	-0.0470*	-0.0152	0.0437	0.0294	0.0289**	0.0129
	(0.0260)	(0.0183)	(0.0257)	(0.0275)	(0.0150)	(0.0182)
	[0.0764]	[0.290]	[0.246]	[0.561]	[0.0231]	[0.493]
Treated	0.524	0.465	0.818*	0.865	0.138	0.907
	(0.436)	(0.448)	(0.441)	(0.735)	(0.468)	(0.412)
	[0.525]	[0.786]	[0.0699]	[0.766]	[0.867]	[0.536]
Treated × Age	-0.0322	-0.0337	-0.0648*	-0.0693	-0.0127	-0.0687
	(0.0314)	(0.0311)	(0.0358)	(0.0520)	(0.0352)	(0.0313)
	[0.688]	[0.873]	[0.0856]	[0.717]	[0.865]	[0.564]
Mean baseline boys	3.260	3.380	2.990	2.680	2.930	-0.410
Mean baseline girls	3.560	3.650	3.250	3.120	3.180	0.070
Observations	932	932	931	932	930	929
Control 50/50	0.101	0.0592	-0.240	-0.234	0.119	-0.0597
	(0.122)	(0.0971)	(0.142)	(0.139)	(0.121)	(0.0995)
	[0.448]	[0.535]	[0.141]	[0.131]	[0.371]	[0.583]
Control 75/25	0.314	0.269	-0.114	0.125	0.139	0.236
	(0.228)	(0.193)	(0.222)	(0.378)	(0.115)	(0.212)
	[0.197]	[0.206]	[0.656]	[0.782]	[0.291]	[0.320]
P-val joint test	0.400	0.300	0.590	0.360	0.890	0.190
Mean baseline	3.450	3.490	3.210	2.930	3.010	-0.130
Observations	823	823	823	824	822	820

Table shows results from fixed effects OLS estimation. Fixed effects are at the child level, and regressions include a post variable (not shown). "Don't know" and "refused" responses are coded as missing, which explains the differences in observation numbers across columns. Standard errors are clustered at the level of the club and shown in (). Randomization inference p-values from 1,000 draws in []. Variables are as listed in the first 5 columns. Column 6 is the sum of the previous columns, standardized. Standard errors are clustered at the level of the club. Direct treatment effect estimations (top 4 panels) exclude controls from treated clubs. The Westfall-Young test of any effect of the experiment across all columns in the top panel is 0.624 , and for spillovers, is 0.749 . The last panel includes only controls, with indicators for post-treatment in 50% or 75% saturation clubs. The p-value listed in the table footer is the p-value for an F-test that both of the indicators on the spillover effects are equal to zero. *** p < 0.01, ** p<0.05, * p< 0.10 based upon the randomization inference p-values.

Table B3: Workshop impacts on kids' mangrove attitudes

			First thought about mangroves		
	More mangroves (1)	Mangoves over beach (2)	Negative (3)	Nature (4)	Tourism (5)
Treated	0.208***	0.114	-0.110**	0.154**	-0.0315**
	(0.0588)	(0.0718)	(0.0479)	(0.0607)	(0.0137)
	[0.00398]	[0.111]	[0.0393]	[0.0178]	[0.0330]
Treated	0.238**	0.122	-0.109*	0.153*	-0.0378**
	(0.0862)	(0.0892)	(0.0650)	(0.0745)	(0.0170)
	[0.0220]	[0.274]	[0.0919]	[0.0840]	[0.0403]
Treated × Female	-0.0550	-0.0161	-0.00268	0.00298	0.0112
	(0.0860)	(0.0854)	(0.0716)	(0.0840)	(0.0113)
	[0.436]	[0.942]	[0.965]	[0.986]	[0.363]
Treated	-0.377	-0.215	0.0597	0.235	-0.0271**
	(0.246)	(0.200)	(0.0916)	(0.178)	(0.0139)
	[0.543]	[0.206]	[0.383]	[0.276]	[0.0433]
Treated × Time since treated	0.0394	0.0226	-0.0117**	-0.00558	-0.000299
	(0.0163)	(0.0136)	(0.00690)	(0.0118)	(0.000521)
	[0.163]	[0.124]	[0.0447]	[0.571]	[0.770]
Treated	0.0583	0.0964	0.276**	-0.251	-0.00884
	(0.322)	(0.201)	(0.137)	(0.263)	(0.0221)
	[0.810]	[0.811]	[0.0499]	[0.542]	[0.834]
Treated × Age	0.0121	0.00135	-0.0302**	0.0316	-0.00177
	(0.0239)	(0.0143)	(0.0108)	(0.0204)	(0.00181)
	[0.475]	[0.987]	[0.0117]	[0.238]	[0.598]
Mean baseline boys	0.550	0.400	0.160	0.610	0.010
Mean baseline girls	0.450	0.360	0.200	0.500	0.000
Observations	778	913	932	932	932
Control 50/50	-0.0371	0.0801	-0.0397	-0.0138	0.0170
	(0.0542)	(0.0618)	(0.0521)	(0.0526)	(0.0219)
	[0.533]	[0.251]	[0.479]	[0.803]	[0.481]
Control 75/25	0.167*	-0.121	-0.0568	-0.0833	-0.0265*
	(0.0821)	(0.0876)	(0.0877)	(0.0871)	(0.0127)
	[0.0974]	[0.276]	[0.571]	[0.445]	[0.0880]
P-val joint test	0.060	0.030	0.670	0.630	0.010
Mean baseline	0.500	0.390	0.170	0.580	0.000
Observations	692	815	824	824	824

Table shows results from fixed effects OLS estimation. Fixed effects are at the child level, and regressions include a post variable (not shown). Variables are as listed in the first 5 columns. Columns (3)-(5) categorize kids answers to the question "What is the first thing that comes to mind when you think about mangroves?". Standard errors are clustered at the level of the club and shown in (). Randomization inference p-values from 1,000 draws in []. Variables are as listed in the first 5 columns. The Westfall-Young test of any effect of the experiment across all columns in the top panel is 0.015 , and for spillovers, is 0.552 . Direct treatment effect estimations (top 4 panels) exclude controls from treated clubs. The last panel includes only controls, with indicators for post-treatment in 50% or 75% saturation clubs. The p-value listed in the table footer is the p-value for an F-test that both of the indicators on the spillover effects are equal to zero. *** p < 0.01, ** p<0.05, * p< 0.10 based upon the randomization inference p-values.

Table B4: Workshop impacts on kids' behaviors

	No littering (1)	Turned off tv (2)	Turned off radio (3)	No plastic bag (4)	Behavior index (5)
Treated	0.117*	0.0474	0.0312	-0.0102	0.0335
	(0.0587)	(0.0402)	(0.0392)	(0.0471)	(0.0313)
	[0.0569]	[0.238]	[0.435]	[0.817]	[0.308]
Treated	0.0944	0.0703	0.0450	0.00752	0.0378
	(0.0867)	(0.0521)	(0.0660)	(0.0638)	(0.0365)
	[0.282]	[0.203]	[0.500]	[0.906]	[0.307]
Treated × Female	0.0400	-0.0418	-0.0254	-0.0317	-0.00767
	(0.0812)	(0.0538)	(0.0739)	(0.0548)	(0.0363)
	[0.586]	[0.411]	[0.833]	[0.453]	[0.841]
Treated	0.138	0.131	-0.0463	0.0120	0.0535
	(0.222)	(0.116)	(0.116)	(0.169)	(0.0980)
	[0.468]	[0.308]	[0.709]	[0.941]	[0.450]
Treated × Time since treated	-0.00150	-0.00569	0.00536	-0.00153	-0.00138
	(0.0157)	(0.00894)	(0.00790)	(0.0112)	(0.00717)
	[0.889]	[0.514]	[0.525]	[0.908]	[0.846]
Treated	0.00535	0.0804	-0.0568	0.143	0.0524
	(0.199)	(0.135)	(0.225)	(0.169)	(0.119)
	[0.968]	[0.644]	[0.840]	[0.536]	[0.568]
Treated × Age	0.00870	-0.00263	0.00699	-0.0119	-0.00147
	(0.0155)	(0.00996)	(0.0159)	(0.0120)	(0.00912)
	[0.419]	[0.862]	[0.800]	[0.484]	[0.814]
Mean baseline boys	0.660	0.930	0.860	0.150	0.620
Mean baseline girls	0.800	0.870	0.900	0.170	0.650
Observations	931	849	675	928	931
Control 50/50	0.0285	0.0606	-0.0644*	0.00233	0.0179
	(0.0708)	(0.0495)	(0.0339)	(0.0598)	(0.0388)
	[0.708]	[0.232]	[0.0769]	[0.967]	[0.702]
Control 75/25	0.0114	-0.0208	0.0462	-0.0152	-0.0136
	(0.112)	(0.0753)	(0.0555)	(0.0938)	(0.0409)
	[0.928]	[0.808]	[0.474]	[0.882]	[0.807]
P-val joint test	0.920	0.410	0.090	0.980	0.790
Mean baseline	0.760	0.900	0.930	0.180	0.650
Observations	824	749	589	822	824

Table shows results from fixed effects OLS estimation. Fixed effects are at the child level, and regressions include a post variable (not shown). A number of children responded that they did not have or use the radio or television or go to the store in the last week, which lowered the number of available responses for columns (2), (3) and (4). The last column is an index of positive environmental behaviors including the outcomes from the first two columns and also whether the child turned off the radio and/or television after watching during the past week. Standard errors are clustered at the level of the club and shown in (). Randomization inference p-values from 1,000 draws in []. Variables are as listed in the first 5 columns. The Westfall-Young test of any effect of the experiment across all columns in the top panel is 0.227 and for all spillovers 0.475 . Direct treatment effect estimations (top 4 panels) exclude controls from treated clubs. The last panel includes only controls, with indicators for post-treatment in 50% or 75% saturation clubs. The p-value listed in the table footer is the p-value for an F-test that both of the indicators on the spillover effects are equal to zero. *** p < 0.01, ** p<0.05, * p< 0.10 based upon the randomization inference p-values.

Table B5: Workshop impacts on kids' knowledge

	Knows what mangroves are (1)	Climate services (2)	Biodiv. services (3)	Consumptive services (4)	Knowledge index (5)
Treated	0.081	0.071	-0.029	0.071	0.177
	(0.079)	(0.043)	(0.047)	(0.058)	(0.137)
Spillovers, 50%	-0.003	0.061	-0.049	0.040	0.081
	(0.065)	(0.045)	(0.058)	(0.065)	(0.154)
Spillovers, 75%	0.030	0.027	-0.140	0.269**	0.244
	(0.083)	(0.134)	(0.100)	(0.097)	(0.261)
Mean baseline	0.350	0.170	0.160	0.250	-0.050
Observations	1224.000	1226.000	1226.000	1226.000	1226.000

Table shows results from fixed effects OLS estimation. Spillover population is included in the estimation. Fixed effects are at the child level, and regressions include a post variable (not shown). Standard errors are clustered at the level of the club and shown in (). Each of the service types is an indicator that the child mentioned an environmental services in that category. The knowledge index is the total count across all of these, standardized. *** $p < 0.01$, ** $p<0.05$, * $p< 0.10$.

Table B6: Workshop impacts on kids' environmental attitudes

	D.R. env. worries (1-4) (1)	Global env worries (1-4) (2)	Concern water (0-4) (3)	Concern waste (0-4) (4)	Free riding 0/1 (5)	Concern index z score (6)
Treated	0.112	0.112	-0.012	-0.023	-0.025	0.027
	(0.076)	(0.076)	(0.118)	(0.124)	(0.071)	(0.071)
Spillovers, 50%	0.101	0.101	-0.240	-0.234	0.119	-0.060
	(0.122)	(0.122)	(0.142)	(0.139)	(0.121)	(0.099)
Spillovers, 75%	0.314	0.314	-0.114	0.125	0.139	0.236
	(0.228)	(0.228)	(0.222)	(0.378)	(0.115)	(0.212)
Mean baseline	3.440	3.440	3.190	2.940	3.040	-0.130
Observations	1226.000	1226.000	1226.000	1228.000	1224.000	1220.000

Table shows results from fixed effects OLS estimation. Estimations include spillover sample. Fixed effects are at the child level, and regressions include a post variable (not shown). "Don't know" and "refused" responses are coded as missing, which explains the differences in observation numbers across columns. Standard errors are clustered at the level of the club and shown in (). Variables are as listed in the first 5 columns. Column 6 is the sum of the previous columns, standardized. Standard errors are clustered at the level of the club. *** p < 0.01, ** p<0.05, * p< 0.10.

Table B7: Workshop impacts on kids' mangrove attitudes

			First thought about mangroves		
	More mangroves	Mangoves over beach	Negative	Nature	Tourism
	(1)	(2)	(3)	(4)	(5)
Treated	0.208***	0.114	-0.110**	0.154**	-0.031**
	(0.059)	(0.072)	(0.048)	(0.061)	(0.014)
Spillovers, 50%	-0.037	0.080	-0.040	-0.014	0.017
	(0.054)	(0.062)	(0.052)	(0.053)	(0.022)
Spillovers, 75%	0.167*	-0.121	-0.057	-0.083	-0.027**
	(0.082)	(0.088)	(0.088)	(0.087)	(0.013)
Mean baseline	0.490	0.360	0.180	0.570	0.000
Observations	878.000	1190.000	1228.000	1228.000	1228.000

Table shows results from fixed effects OLS estimation using the full sample include spillover population. Fixed effects are at the child level, and regressions include a post variable (not shown). Variables are as listed in the first 5 columns. Columns (3)-(5) categorize kids answers to the question "What is the first thing that comes to mind when you think about mangroves?". Standard errors are clustered at the level of the club and shown in (). Variables are as listed in the first 5 columns. *** $p < 0.01$, ** $p<0.05$, * $p< 0.10$.

Table B8: Workshop impacts on kids' behaviors

	No littering (1)	Turned off tv (2)	Turned off radio (3)	No plastic bag (4)	Behavior index (5)
Treated	0.117*	0.047	0.031	-0.010	0.034
	(0.059)	(0.040)	(0.039)	(0.047)	(0.031)
Spillovers, 50%	0.028	0.061	-0.064*	0.002	0.018
	(0.071)	(0.049)	(0.034)	(0.060)	(0.039)
Spillovers, 75%	0.011	-0.021	0.046	-0.015	-0.014
	(0.111)	(0.075)	(0.055)	(0.094)	(0.041)
Mean baseline	0.650	0.930	0.890	0.170	0.620
Observations	1226.000	1028.000	694.000	1218.000	1226.000

Table shows results from fixed effects OLS estimation using the full sample including spillover population. Fixed effects are at the child level, and regressions include a post variable (not shown). A number of children responded that they did not have or use the radio or television or go to the store in the last week, which lowered the number of available responses for columns (2), (3) and (4). The last column is an index of positive environmental behaviors including the outcomes from the first two columns and also whether the child turned off the radio and/or television after watching during the past week. Standard errors are clustered at the level of the club and shown in (). *** $p < 0.01$, ** $p<0.05$, * $p< 0.10$.

C Disaggregated tables – parents

Table C1: Workshop impacts on parents' knowledge

	Believe mangroves beneficial (1)	Climate services (2)	Biodiv. services (3)	Consumptive services (4)	Knowledge index (5)
Treated	0.0427	-0.200*	-0.0289	0.193*	-0.0675
	(0.0521)	(0.0923)	(0.0654)	(0.0995)	(0.181)
	[0.427]	[0.0624]	[0.713]	[0.0717]	[0.721]
Treated	0.00554	-0.199	0.00909	0.122	-0.127
	(0.0681)	(0.144)	(0.109)	(0.150)	(0.246)
	[0.977]	[0.154]	[0.942]	[0.436]	[0.625]
Treated × Female	0.0548	0.0137	-0.0426	0.104	0.139
	(0.0589)	(0.152)	(0.121)	(0.141)	(0.218)
	[0.947]	[0.896]	[0.623]	[0.512]	[0.613]
Treated	0.399*	-0.405	-0.459	0.532	-0.616
	(0.155)	(0.320)	(0.260)	(0.373)	(0.863)
	[0.0679]	[0.223]	[0.656]	[0.212]	[0.433]
Treated × Time since treated	-0.0244*	0.0141	0.0296	-0.0234	0.0378
	(0.0112)	(0.0204)	(0.0173)	(0.0277)	(0.0613)
	[0.0774]	[0.437]	[0.680]	[0.520]	[0.554]
Treated	0.0388	-0.196*	-0.0358	0.205*	-0.0499
	(0.0517)	(0.0902)	(0.0675)	(0.0945)	(0.181)
	[0.445]	[0.0563]	[0.643]	[0.0560]	[0.747]
Treated × environmental risk	-0.0600	0.0316	-0.0550	0.0930	0.129
	(0.0412)	(0.0718)	(0.0506)	(0.0793)	(0.120)
	[0.708]	[0.721]	[0.862]	[0.436]	[0.972]
Mean baseline men	0.830	0.550	0.300	0.460	0.210
Mean baseline women	0.600	0.540	0.190	0.390	-0.160
Observations	801	520	520	520	520

Table shows results from fixed effects OLS estimation. Fixed effects are at the child level, and regressions include a post variable (not shown). Standard errors are clustered at the level of the club and shown in (). Randomization inference p-values from 1,000 draws in []. Observations are considerably lower in columns (2)-(5), as these responses were only given by parents who responded that they believe that mangroves had beneficial characteristics. The each of the service types is a count of the number of environmental services in each category that were mentioned in the child's response. The knowledge index is the total count across all of these, standardized. Direct treatment effect estimations (top 4 panels) exclude controls from treated clubs. The Westfall-Young test of any effect of the experiment across all columns in the first panel is 0.257 . *** $p < 0.01$, ** $p<0.05$, * $p< 0.10$ based upon the randomization inference p-values.

Table C2: Workshop impacts on parents' environmental attitudes

	D.R. env. worries (1-4) (1)	Global env worries (1-4) (2)	Concern water (0-4) (3)	Concern waste (0-4) (4)	Conserve env/econ (1-4) (5)	Free riding (1-4) (6)	Concern index z score (7)
Treated	0.179**	0.155	-0.0694	0.115	0.131	0.0647	0.143
	(0.0924)	(0.0959)	(0.165)	(0.125)	(0.0929)	(0.0968)	(0.0915)
	[0.0479]	[0.103]	[0.673]	[0.378]	[0.173]	[0.515]	[0.113]
Treated	-0.0245	-0.0305	-0.410	0.148	0.0360	-0.0162	-0.0741
	(0.0995)	(0.114)	(0.225)	(0.154)	(0.119)	(0.140)	(0.0791)
	[0.834]	[0.719]	[0.138]	[0.231]	[0.750]	[0.900]	[0.393]
Treated × Female	0.298	0.271**	0.496*	-0.0628	0.137	0.101	0.309**
	(0.213)	(0.159)	(0.173)	(0.173)	(0.141)	(0.145)	(0.0860)
	[0.158]	[0.0218]	[0.0776]	[0.624]	[0.292]	[0.301]	[0.0185]
Treated	-0.449	-0.810***	0.263	0.111	0.982**	0.0428	0.0349
	(0.435)	(0.336)	(0.712)	(0.682)	(0.316)	(0.447)	(0.444)
	[0.199]	[0.00232]	[0.775]	[0.890]	[0.0113]	[0.894]	[0.948]
Treated × Time since treated	0.0429	0.0660***	-0.0227	0.000296	-0.0582**	0.00149	0.00741
	(0.0307)	(0.0235)	(0.0514)	(0.0460)	(0.0219)	(0.0271)	(0.0332)
	[0.130]	[0.00379]	[0.710]	[0.995]	[0.0201]	[0.937]	[0.814]
Treated	0.176**	0.158*	-0.0685	0.119	0.128	0.0607	0.143*
	(0.0890)	(0.0952)	(0.163)	(0.128)	(0.0987)	(0.0976)	(0.0915)
	[0.0439]	[0.0892]	[0.698]	[0.365]	[0.152]	[0.543]	[0.0994]
Treated × environmental risk	-0.0428	0.0389	0.00965	0.0515	-0.0324*	-0.0510	-0.00653
	(0.0813)	(0.0726)	(0.104)	(0.126)	(0.0500)	(0.0750)	(0.0722)
	[0.397]	[0.205]	[0.153]	[0.374]	[0.0930]	[0.550]	[0.115]
Mean baseline men	3.670	3.620	3.240	3.290	3.140	3.190	0.210
Mean baseline women	3.460	3.420	3.040	3.000	3.080	3.030	-0.070
Observations	813	813	813	813	813	813	813

Table shows results from fixed effects OLS estimation. Fixed effects are at the child level, and regressions include a post variable (not shown). Standard errors are clustered at the level of the club and shown in (). Randomization inference p-values from 1,000 draws in []. Variables are as listed in the first 5 columns. Column 7 is the sum of the previous columns, standardized. Standard errors are clustered at the level of the club. Direct treatment effect estimations (top 4 panels) exclude controls from treated clubs. The Westfall-Young test of any effect of the experiment across all columns in the first panel is 0.254 . *** p < 0.01, ** p<0.05, * p< 0.10 based upon the randomization inference p-values.

Table C3: Workshop impacts on parents' mangrove attitudes

				First thought about mangroves		
	More mangroves (1)	Mangoves over beach (2)	Rank mangroves (3)	Negative (4)	Nature (5)	Tourism (6)
Treated	0.0594	-0.127	0.0395	0.0395	0.0528	-0.00673
	(0.0628)	(0.0812)	(0.0435)	(0.0435)	(0.0684)	(0.0270)
	[0.361]	[0.150]	[0.368]	[0.368]	[0.444]	[0.806]
Treated	-0.0130	-0.0948	0.449*	-0.00948	-0.0753	0.0190
	(0.0690)	(0.106)	(0.216)	(0.0402)	(0.0875)	(0.0408)
	[0.901]	[0.384]	[0.0949]	[0.803]	[0.682]	[0.658]
Treated × Female	0.108	-0.0487	-0.122	0.0724**	0.190	-0.0377
	(0.0767)	(0.104)	(0.236)	(0.0487)	(0.0898)	(0.0384)
	[0.548]	[0.514]	[0.885]	[0.0314]	[0.392]	[0.317]
Treated	0.208	-0.0975	0.951	0.168	-0.196	0.0490
	(0.177)	(0.149)	(0.634)	(0.298)	(0.409)	(0.138)
	[0.138]	[0.506]	[0.142]	[0.610]	[0.594]	[0.664]
Treated × Time since treated	-0.0100	-0.00204	-0.0392	-0.00882	0.0171	-0.00383
	(0.0117)	(0.00943)	(0.0442)	(0.0187)	(0.0258)	(0.00973)
	[0.285]	[0.837]	[0.314]	[0.691]	[0.493]	[0.629]
Treated	0.0526	-0.130	0.383**	0.0418	0.0491	-0.00742
	(0.0603)	(0.0803)	(0.146)	(0.0454)	(0.0683)	(0.0266)
	[0.398]	[0.134]	[0.0170]	[0.375]	[0.451]	[0.782]
Treated × environmental risk	-0.0220	-0.0535	0.145	0.0333	-0.0499	-0.00900
	(0.0441)	(0.0447)	(0.106)	(0.0364)	(0.0423)	(0.0214)
	[0.493]	[0.279]	[0.165]	[0.761]	[0.579]	[0.512]
Mean baseline men	0.850	0.530	2.840	0.050	0.870	0.020
Mean baseline women	0.580	0.440	2.380	0.110	0.680	0.040
Observations	692	764	759	789	789	789

Table shows results from fixed effects OLS estimation. Fixed effects are at the household level, and regressions include a post variable (not shown). Variables are as listed in the first 5 columns. Columns (4)-(6) categorize kids answers to the question "What is the first thing that comes to mind when you think about mangroves?". Standard errors are clustered at the level of the club and shown in (). Randomization inference p-values from 1,000 draws in []. Variables are as listed in the first 5 columns. The Westfall-Young test of any effect of the experiment across all columns in the first panel is 0.114 *** p < 0.01, ** p<0.05, * p< 0.10 based upon the randomization inference p-values.

Table C4: Workshop impacts on parents' behaviors

	No littering (1)	Turned off tv (2)	Turned off radio (3)	No plastic bag (4)	Behavior index (5)
Treated	0.0270	0.0408	0.0392	0.0248	0.0528**
	(0.0225)	(0.0287)	(0.0307)	(0.0428)	(0.0209)
	[0.281]	[0.216]	[0.217]	[0.613]	[0.0250]
Treated	0.0408	0.0444	0.00763	0.0498	0.0648**
	(0.0393)	(0.0493)	(0.0483)	(0.0619)	(0.0280)
	[0.338]	[0.397]	[0.888]	[0.428]	[0.0303]
Treated × Female	-0.0198	-0.00523	0.0484	-0.0446	-0.0198
	(0.0365)	(0.0536)	(0.0489)	(0.0447)	(0.0240)
	[0.508]	[0.939]	[0.265]	[0.287]	[0.266]
Treated	0.0629	0.0195	0.0908	0.293	0.0747
	(0.0742)	(0.0837)	(0.122)	(0.124)	(0.0477)
	[0.378]	[0.816]	[0.547]	[0.237]	[0.241]
Treated × Time since treated	-0.00245	0.00147	-0.00354	-0.0183	-0.00150
	(0.00516)	(0.00560)	(0.00866)	(0.00816)	(0.00341)
	[0.609]	[0.774]	[0.760]	[0.275]	[0.801]
Treated	0.0279	0.0379	0.0255	0.0259	0.0518**
	(0.0222)	(0.0287)	(0.0294)	(0.0426)	(0.0205)
	[0.266]	[0.240]	[0.393]	[0.556]	[0.0263]
Treated × environmental risk	0.0106	-0.0427*	-0.0875**	0.0103	-0.0124
	(0.0144)	(0.0239)	(0.0317)	(0.0299)	(0.0172)
	[0.494]	[0.0927]	[0.0117]	[0.885]	[0.971]
Mean baseline men	0.960	0.960	0.960	0.170	0.730
Mean baseline women	0.970	0.940	0.960	0.080	0.700
Observations	813	722	593	810	813

Table shows results from fixed effects OLS estimation. Fixed effects are at the child level, and regressions include a post variable (not shown). The third column is an index of positive environmental behaviors including the outcomes from the first two columns and also whether the parent turned off the radio and/or television after watching during the past week. Standard errors are clustered at the level of the club and shown in (). Randomization inference p-values from 1,000 draws in []. The Westfall-Young test of any effect of the experiment across all columns in the first panel is 0.110 Estimates exclude parents of kids who were controls in treated clubs. *** $p < 0.01$, ** $p<0.05$, * $p< 0.10$ based upon the randomization inference p-values.

Table C5: Workshop impacts on parents' knowledge

	Believe mangroves beneficial (1)	Climate services (2)	Biodiv. services (3)	Consumptive services (4)	Knowledge index (5)
Treated	0.091	-0.211**	0.006	0.218**	0.025
	(0.064)	(0.102)	(0.080)	(0.100)	(0.194)
Spillover, 50%	0.011	-0.085	-0.017	0.176	0.138
	(0.056)	(0.111)	(0.089)	(0.145)	(0.184)
Spillover, 75%	0.102	-0.011	-0.091	-0.009	-0.206
	(0.147)	(0.204)	(0.109)	(0.117)	(0.357)
Mean baseline	0.670	0.580	0.220	0.430	0.080
Observations	980.000	474.000	474.000	474.000	474.000

Table shows results from fixed effects OLS estimation including the spillover sample. Fixed effects are at the child level, and regressions include a post variable (not shown). Standard errors are clustered at the level of the club and shown in ().Observations are considerably lower in columns (2)-(5), as these responses were only given by parents who responded that they believe that mangroves had beneficial characteristics. The each of the service types is an indicator that the parent mentioned an environmental service falling in the category of the header. The knowledge index is the total count across all of these, standardized. *** $p < 0.01$, ** $p<0.05$, * $p< 0.10$.

Table C6: Workshop impacts on parents' environmental attitudes

	D.R. env. worries (1-4) (1)	Global env worries (1-4) (2)	Concern water (0-4) (3)	Concern waste (0-4) (4)	Conserve env/econ (1-4) (5)	Free riding (1-4) (6)	Concern index z score (7)
Treated	0.150*	0.089	-0.054	0.215	0.104	0.038	0.135
	(0.077)	(0.087)	(0.172)	(0.132)	(0.101)	(0.098)	(0.086)
Spillover, 50%	0.233***	-0.119	-0.064	-0.181	0.149	0.229**	0.061
	(0.075)	(0.081)	(0.153)	(0.199)	(0.105)	(0.095)	(0.069)
Spillover, 75%	0.169	0.029	-0.361	0.113	0.098	-0.085	-0.010
	(0.213)	(0.190)	(0.365)	(0.133)	(0.128)	(0.124)	(0.195)
Mean baseline							
Observations	1014.000	1014.000	1014.000	1014.000	1014.000	1014.000	1014.000

Table shows results from fixed effects OLS estimation using the sample including the spillover popuolation. Fixed effects are at the child level, and regressions include a post variable (not shown). Standard errors are clustered at the level of the club and shown in (). Variables are as listed in the first 5 columns. Column 7 is the sum of the previous columns, standardized. Standard errors are clustered at the level of the club. *** p < 0.01, ** p<0.05, * p< 0.10.

Table C7: Workshop impacts on parents' mangrove attitudes

				First thought about mangroves		
	More mangroves (1)	Mangoves over beach (2)	Rank mangroves (3)	Negative (4)	Nature (5)	Tourism (6)
Treated	0.054	-0.120	0.390**	0.018	0.040	0.003
	(0.069)	(0.081)	(0.157)	(0.047)	(0.070)	(0.027)
Spillover, 50%	-0.025	-0.104	0.290**	-0.056*	0.067	0.000
	(0.058)	(0.093)	(0.134)	(0.032)	(0.056)	(0.022)
Spillover, 75%	0.170	-0.114	0.377*	-0.153***	0.113	0.043
	(0.204)	(0.107)	(0.198)	(0.055)	(0.109)	(0.086)
Mean baseline	0.690	0.490	2.500	0.110	0.740	0.040
Observations	770.000	958.000	898.000	946.000	946.000	946.000

Table shows results from fixed effects OLS estimation using the full sample including the spillover population. Fixed effects are at the household level, and regressions include a post variable (not shown). Variables are as listed in the first 5 columns. Columns (4)-(6) categorize kids answers to the question "What is the first thing that comes to mind when you think about mangroves?". Standard errors are clustered at the level of the club and shown in (). Variables are as listed in the first 5 columns. *** $p < 0.01$, ** $p<0.05$, * $p< 0.10$.

Table C8: Workshop impacts on parents' behaviors

	No littering (1)	Turned off tv (2)	Turned off radio (3)	No plastic bag (4)	Behavior index (5)
Treated	0.029	0.049*	0.030	0.016	0.049**
	(0.024)	(0.027)	(0.031)	(0.049)	(0.023)
Spillover, 50%	0.024	0.018	0.038	0.019	0.014
	(0.022)	(0.039)	(0.028)	(0.060)	(0.023)
Spillover, 75%	0.005	0.054	0.008	0.089	0.051
	(0.059)	(0.045)	(0.083)	(0.056)	(0.034)
Mean baseline	0.970	0.950	0.960	0.100	0.710
Observations	1014.000	820.000	606.000	1008.000	1014.000

Table shows results from fixed effects OLS estimation using the full sample including the spillover population. Fixed effects are at the child level, and regressions include a post variable (not shown). The third column is an index of positive environmental behaviors including the outcomes from the first two columns and also whether the parent turned off the radio and/or television after watching during the past week. Standard errors are clustered at the level of the club and shown in ().*** $p < 0.01$, ** $p<0.05$, * $p< 0.10$.

D Honey purchases

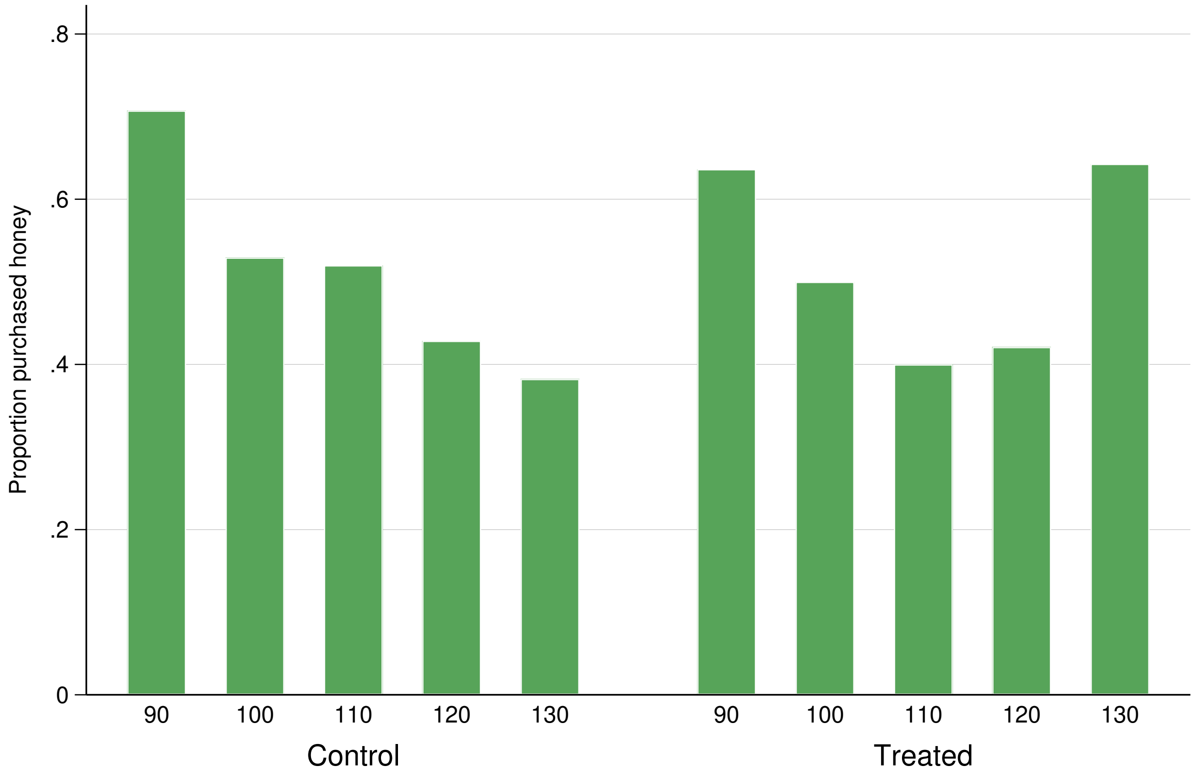


Figure D1: Summary of honey purchases, kids

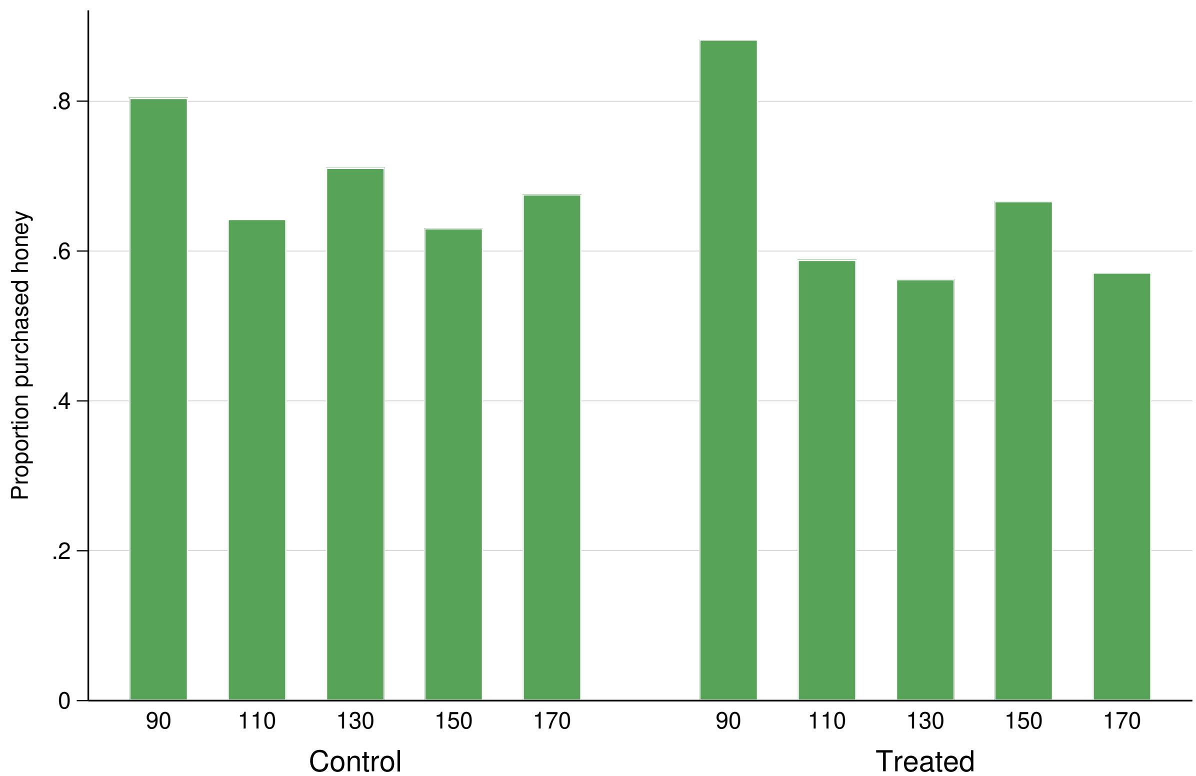


Figure D2: Summary of honey purchases, adults