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EVERY DAY IS EARTH DAY: EVIDENCE ON THE LONG-TERM IMPACT OF ENVIRONMENTAL VOLUNTARISM

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ABSTRACT

We use variation in weather to study the long-term effects of the original Earth Day on attitudes, environmental outcomes, and children's health. Unusually bad weather in a community on April 22, 1970, is associated 10 to 20 years later with weaker support for the environment, particularly among those who were school-aged in 1970. Bad weather on Earth Day is also associated with higher levels of carbon monoxide in the air and greater risk of congenital abnormalities in infants born in the following decades. These results indicate a long-lasting and localized effect of Earth Day, and more generally demonstrate the enduring value of voluntary environmental action

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1. *Introduction*

In recent decades, ordinary people have frequently taken action to address environmental problems, but it is not always clear what is gained by their doing so. For example, in September 2019, millions of students across the world participated in strikes intended to draw attention to the environmental problem of climate change (Sengupta, 2019). This was lauded by many observers, but also criticized by both policy makers (Watts, 2019; and Australian AP, 2018) and by observers in the popular press (e.g., Freeman, 2020; Caldwell, 2019; see also Heglar, 2018; Lukacs, 2018; Geiling, 2018; Matthews, 2017). Many critiques questioned whether the actions of individuals matter. In the words of prominent activist Greta Thunberg, “the favorite argument here in Sweden, and everywhere else, is that it doesn’t matter what we do because we are all too small to make a difference” (Carrington, 2019).

This climate-strike response reflects a broader uncertainty over the benefits of voluntary actions to support the environment. A body of research has found that low levels of voluntary action on environmental issues often stems not from doubt over the importance of environmental problems, but from doubt that one’s actions can make a difference (Akpan, 2019; Salomon, Preston, Tannenbaum, 2017; Semenza et al., 2008; Huebnerand Lipsey, 1981; Xu, Chi and Zhu, 2017; Rankin, 1969). Doubt that one can make a difference thus calls into question the efforts of those who do act, and serves as a rationalization for those who do not. If this type of doubt is justified, then a low level of environmental voluntarism could be useful, as it would direct individuals away from taking costly actions of no benefit. But if this doubt is misplaced, the cost of directing efforts away from environmental actions could be high or even catastrophic.

The goal of this paper is to provide new evidence on the impact of environmental voluntarism by considering the original Earth Day, April 22, 1970. On this day, millions of ordinary people came together in an effort to alter the the values, environmental quality, and health of their communities. We explore whether the circumstances in a community on the original Earth Day relate to outcomes in that community over the next 20 years.

We first investigate whether Earth Day had long-term impacts on environmental attitudes. Such a study runs the danger of reverse causation: places that had successful Earth Day celebrations might be places with strong pro-environmental attitudes, and it is the enduring attitudes that lead to a successful Earth Day, rather than the other way around. We address this concern by exploiting variation in the weather on Earth Day, comparing places that had unusually good or unusually bad weather on the exact date in question. Our key assumption is that unexpectedly good/bad weather on this date should not be related to confounders like underlying community attitudes about the environment. If this assumption is correct, we can interpret a strong relation between weather shocks on April 22, 1970 and outcomes many years later as evidence for the importance of Earth Day.

Using data from the 1977-1993 waves of the General Social Survey, we find that weather on Earth Day has a statistically significant effect on attitudes: individuals in places with bad weather on Earth Day express less support for environmental spending 10 to 20 years afterwards. This result is observed in particular for those who were under age 20 at the time of Earth Day. For this group, a one-standard-deviation increase in precipitation corresponds to roughly a 0.1 standard-deviation increase in opposition to environmental spending. Weather shocks on *other* days from that April generally have no effect.

We next see if Earth Day affected the quality of the environment. To measure local environmental quality, we use data on air pollution. We find that bad weather on Earth Day is associated years later with higher levels of air pollution, specifically carbon monoxide (CO). A one-standard deviation increase in precipitation leads to a 0.085 standard-deviation increase in average CO over the next 20 years. When we look at other non-localized types of air pollution, such as ozone, we find no effect.

Finally, following a large empirical literature that relates environmental quality to infant health (e.g., Zivin and Neidell, 2013), we find evidence connecting the original Earth Day to the health of newborns. A one-standard deviation increase in precipitation on Earth Day is associated 10 to 20 years later with a 0.15 standard-deviation increase in the fraction of births with a congenital abnormality. The evidence is suggestive that this result is stronger for children born to low SES women.

Our results have several implications. First, they provide novel evidence that ordinary people's voluntary environmental actions do matter. Prior work has considered the causes and importance of voluntary environmental behavior; Price (2014) gives an overview. But this area of work is relatively small compared to work on government programs and policies to improve the environment. There is even less work on the *long-term* efficacy of individuals' actions. This is especially noteworthy as the long-term effects for many environmental issues are potentially the ones of greatest consequence. We show that voluntary actions can shape the preferences/beliefs of communities long after the actions themselves happen, and can lead to important improvements in well-being even decades later. We do not know of work that presents large-scale and long-term evidence of benefits as we do here.

Second, our findings have implications for research on evaluating the benefits of voluntary activity generally (Brown, 1999). Work here has noted that the estimated value of volunteering time is often surprisingly small (e.g., Brown, Meer, Williams, 2019). While several factors may drive this result, our work provides evidence on the potential importance of dynamic effects when evaluating voluntary activity (cf. Scharf, Smith, and Wilhelm, 2017). Looking over time, we find that our results on CO, which is our most consistently available outcome during the the period of our sample, only become significant in the mid 1970s, several years after Earth Day. It follows that contemporaneous estimates of voluntarism here would underestimate, potentially by a large amount, the value of voluntarism. In fact, there can be benefits to voluntary activity that would be impossible to identify until years after the volunteering occurs.

Third, our work contributes to research on the environment and health. Some work here has explored how environmental quality can effect health in the long run (e.g., Isen, Rossin-Slater, Walker, 2017); our results differ in that rather than connecting the well-being of adults to the policy circumstances of their births, we focus on a short-term event and observe how this event affects infants born afterwards. This produces a novel implication: that the health effects of a temporary environmental action can endure both from a fetal-origins-style argument and by affecting cohorts born many years later. Our work also differs in that we consider the effects of a voluntary action. Our results indicate that, like policies, voluntary efforts to improve the environment can have important health effects.

Finally, our work changes the interpretation of Earth Day itself. The importance of Earth Day in the history of the environmental movement is widely acknowledged, with Earth Day having played a role in the adoption of important laws such as the Clean Air, Clean Water, and Endangered Species Acts. But accounts of Earth Day typically do not consider effects beyond these changes in federal policy and further conclude that the effects of Earth Day on environmental attitudes were short lived (cf. Fried, 1998; Shabecoff, chapter 5, 1993; Dunlap, 1992). O'Riordan et al. (1995) write that Earth Day "rapidly faded from public view" and, in an influential article, Downs (1972) uses concern about the environment in the early 1970s as a canonical example of an issue which "gradually fades from public attention." Our results indicate the opposite, and more generally emphasize the *highly local* and *long-lasting* benefits of Earth Day. We know of no work in any discipline that documents benefits of this nature for this day. We briefly overview Earth Day next.

2. A Brief Overview of the Original Earth Day

Here we provide background on the first Earth Day. Rome (2013) is a good starting point for those wanting to learn more. Earth Day was conceived by Senator Gaylord Nelson in 1969. Its purpose was, according to Nelson, to "force the issue [of the environment] into the political dialogue of the country" (Lewis, 1990). Nelson originally planned for a national "teach in" day, but his team helped morph the notion into a much broader day. Between 20 and 25 million individuals–roughly one out of every 10 Americans–participated. At the time, Earth Day was the largest organized demonstration in human history (Hayes, 1988).

April 22, 1970, which was a Wednesday, was selected as Earth Day because it was a day without other major competing events. It was also late enough in the spring that the weather would likely be good. The organizers further felt that students would be especially important for Earth Day, and for most students April 22 would fall after spring break but before the end of the school year. Schools and students did play an important part in Earth Day; roughly 1,500 colleges and 10,000 schools held teach-in events (Rome, 2013). The central organizing committee provided information and materials when asked, but ultimately many communities took an ad-hoc approach, offering a variety of events for individuals of different ages and interests.

To illustrate different Earth-Day events and their potential for lasting effects, consider the community of Albion, MI. On Earth Day, a group of Albion citizens gathered to clean up a section of the Kalamazoo River. They were led by an Albion College geology major named Walt Pomeroy. Next, students at Albion College engaged in a mass can-smashing event. Aluminum cans were sold to a scrap facility (curbside recycling was unknown at this time) and non-aluminum cans were returned to their manufacturers to encourage them to change to a reusable material. Students in nearby schools also picked up litter.

The city of Albion had asked students to clean up a section of the river so that it could be turned into a park, and that park is still in operation today. The city also established a recycling center after Earth Day. For the student organizer Walt Pomeroy, participation in Earth Day was "the beginning of a lifelong dedication to environmental causes" (Albion, 2016). Pomeroy created the Michigan Student Environmental Confederation, a group that came to represent over 100 local student environmental organizations, while working with local and federal government officials to improve environmental policy (U.S. government printing office, 1971). He subsequently became a regional vice president of the National Audobon Society (Dempsey, 2019). He credits Earth Day for helping to promote important local outcomes such as greater availability of returnable cans & bottles, and lowered phosphate levels in detergents (Smith, 2012).

These anecdotes indicate how Earth Day could have lasting effects by changing the infrastructure, leadership, and regulatory environment of communities. However, many communities made steps to improve the environment in the early 1970s, and the case of Albion could conflate Earth Day's effects with broader trends. Albion could be a case of reverse causation: community engagement was high because community leaders were perceived to be receptive to voluntarism. Similarly, for individuals like Walt Pomeroy, actions on Earth Day could reflect an underlying taste for environmental voluntarism; he might have pursued a similar career even without Earth Day. The story of one community also says little about the overall effect of Earth Day. We turn to a broader analysis that addresses these concerns next.

3. Empirical Approach

Our approach will exploit variation in the weather on Earth Day. The original Earth Day was conceived as a one-time event; there was not a widespread recognition of Earth Day again until 1990. We thus focus on the interim period of the 1970s and 1980s, and relate outcomes from this period to weather conditions on the original Earth Day. Our weather data come from U.S. Historical Climatology Network (USHCN). Our unit of analysis from this data is the county and our measure of weather will be precipitation (cf. Madestam et al., 2013). For simplicity we will refer to this as rainfall as almost all precipitation observed on the original Earth Day was rain. However, in general precipitation can include (e.g.) snow. Precipitation is measured in 0.1 mm.

Many contemporaneous accounts of Earth Day mention the benefits of good weather (e.g., Titusville Herald, 1970; Danville Bee, 1970). There is also anecdotal evidence from communities with activities marred by inclement weather (e.g., Brainerd Daily Dispatch, 1970; Oelwein Daily Register, 1970; Ogden Standard-Examiner, 1970). Further, in Section 1 of the Appendix and Appendix Table A1 and Figures A1 and A2 we present results from two different datasets showing that rain on Earth Day lowers environmental voluntarism.

We first use the 1973 Youth Socialization Survey, which asked a national sample of young adults about participation in demonstrations and protests in 1970. Results from this sample indicate that bad weather on Earth Day lowers the likelihood that individuals report taking part in demonstrations or protests in 1970; a 1 standard-deviation increase in rain causes a 1 percentage-point decline in participation. We then use the much larger samples from the 2002-2014 waves of the Current Population Survey to show that rain on recent Earth Days lowers subsequent environmental voluntarism; these point estimates are smaller in magnitude. We take these results as suggestive, as the Youth Survey dataset is small and the CPS data covers later Earth Days. Also, weather likely not only affected the number of participants but also the length and type of actions they took. That said, both anecdotal and quantitative evidence confirm the intuition that weather on Earth Day affects participation, and the estimates below are compatible with changes in participation that are moderately-sized.

April 22, 1970 was a day with good weather in much of the country, but there was widespread variation with virtually every state having at least some precipitation. The northeast and northern plains states received relatively more rain, and there are scattered instances of precipitation on the west coast.[1] Appendix Figure A3 reports precipitation on April 22, 1970 across the country.

When comparing places with precipitation on Earth Day to other places, we will include a number of control variables, many taken from the 1970 census. A list of these variables is given in Appendix Table A2, along with means and standard deviations. Table A2 also reports (a) a coefficient regressing each variable individually on precipitation and (b) a balance test of whether these variables are significantly related to precipitation. The results of Table A2 indicate that precipitation on Earth Day does not appear to be significantly related to community observables.

[1]One might wonder weather the actual weather patterns on Earth Day were close to the forecast patterns, as the weather forecast may have mattered as well. We consulted national weather forecasts from April 21st, and confirmed that in general the realized weather on Earth Day was close to the forecast.

We can explore this issue further in our empirical work. When looking at a particular outcome y in community c in year t, our specification will be:

$$y_{ct} = \alpha + r_c\ \phi + X_{ct}\beta + e_{ct} \tag{1}$$

where r_c, which is not indexed by t, is precipitation on April 22, 1970, and X_{ct} is a set of controls. The scalar ϕ and vector β are to be estimated, and e_{ct} is noise. In our estimates we will vary the set of controls to explore whether they affect estimates of ϕ. Further, we can explore a stronger specification where we control for rain on other days on April 1970. If Earth Day stands out in its relation to later outcomes, this is strong evidence that it is Earth Day, rather than other unobserved elements that vary with weather, which drives our results. Finally, we can also consider results that use deviations from standard weather in our estimates. That is, we calculate the average precipitation on April 22 from 1970 to 1990; call this $\bar{r_c}$. Then in equation (1) we can replace r_c with $(r_c - \bar{r_c})$. This then identifies the deviation from standard weather on Earth Day, capturing the extent to which the weather was unusually good or bad. We can further combine both of these extensions, running regressions on the deviation-from-normal precipitation for various days in April, 1970, and relating them to outcomes years later. Several other comments are in order for the specifications used for each dataset and we discuss them next.

3.1 GSS

As Dunlap (1992) observes, there is little data that allows study of opinions about environmental issues over time during the period of our study. We need such data to be (a) large in size (b) covering much of the nation and (c) providing reasonably precise information on one's local community. We know of one dataset fulfilling these criteria: the General Social Survey, or GSS. The GSS is a long running, roughly biennial survey that is nationally representative. Every year from 1977 to 1993, respondents were asked whether the amount of money that we are spending "improving and protecting the environment" was too little, about right, or too much. We take these responses and use them to estimate equation (1). First, we simply construct an index, where 3 corresponds with too much being spent, 2 corresponds with about-right spending and 1 corresponds with too little. The overall mean sample of the index is 1.5 (sd = 0.65). We also construct a dummy that equals unity if a respondent says we spend "too little" on the environment. The overall mean of this dummy is 0.62 (0.49). We also include a set of individual controls in our GSS specification.[2] GSS data from this period use Primary Sampling Units (PSUs) as the geographic identifier, which is often similar to a metropolitan statistical area. We discuss our use of the PSU identifier and our construction of the GSS data more in the Appendix Section 2.

3.2 Carbon Monoxide

Following many studies (e.g., Currie, Neidell, and Schmieder, 2009, Currie and Neidel, 2005), we consider air pollution as a key measure of environmental quality in the 1970s and 1980s. This choice reflects data availability rather than a belief that Earth Day particularly affected this type of pollution. We focus on carbon monoxide (CO), as it is a pollutant proven to be related to both health outcomes and local activity of individuals.[3]

Following Chay and Greenstone (2003), we obtain annual monitor level CO data from the EPA Air Quality System (AQS).[4] Our data go from 1970 to 1988 and measurements are defined as average parts per million measured over a calendar year. The unit of analysis is the county. In most years we have between 200 and a little over 300 counties with CO readings, but these counties cover over half of the United States population in most of these years. We limit our sample to measurements from monitors that produce at least 15 observations in a year, although this does not substantively affect our results.

[2]These are controls for age, dummies for high school and more-than high school education, gender, race, year of survey, and a dummy for which survey form was used to conduct the survey.

[3]CO is a colorless, odorless gas that enters the atmosphere when something is burned. Key sources of CO in outdoor air include cars, trucks and machines that burn fossil fuels (cf. Knittel, Miller, and Sanders, 2016).

[4]Specifically, we query the AQS API where pollutants and other substances are labeled as parameters. The associated parameter for CO is 42101.

We also estimated the results of Earth Day on other pollutants, including nitrogen dioxide (NO2), sulfur dioxide (SO2), TSP, and Ozone.[5] Importantly, these sources of air pollution can be driven by non-local sources or by activities that would likely not be affected by changes in individuals' voluntary behaviors. For instance, the EPA reports that NO2 and Ozone are capable of traveling several hundreds of miles due to wind and other factors (EPA Technical Bulletin, 1999). Likewise, S02 emissions form compounds and fine particle pollutants (TSPs) which can travel hundreds of miles, making it difficult for downwind states to meet air quality standards (EPA, Clean Air Markets, 2019; EPA, What is Interstate Air, 2019).[6] Given this, we expect (and find) that Earth Day should be less-related/unrelated to the presence of these pollutants in the atmosphere.

3.3 Infant Health

Our data here come from the Natality Detail Files prepared by the Division of Health Statistics of the National Center for Health Statistics. These data include essentially all births in the United States, about 4 million births per year.[7] Our key measure of infant health is congenital abnormalities, which is unavailable before 1979. Coding of this variable changed in 1989, for this reason (and noting as discussed earlier the resumption of celebrating Earth Day in 1990) we use the years 1980 to 1988. The (weighted) mean fraction of births with congenital abnormalities is 0.01 (sd = 0.009). We also discuss results using fetal deaths, compiled by the Centers for Disease Control. Our geographic identifier for both the CDC mortality data and the vital statistics data is the county.

[5]AQS API parameter codes 42602, 42401, 11101, and 44201, respectively.

[6]Additionally, see https://www.epa.gov/sips/basic-information-air-quality-sips for information on how all these pollutants enter the air.

[7]For several states and years a 50% sample is provided; in this case we weight these states so that their sample reflects all births.

4. Earth Day and Long-Run Environmental Attitudes

Figure 1 shows the results of regressing our anti-environment index from the GSS on the deviation-from-historical-precipitation ($r_c - \bar{r_c}$) for each day in April 1970. Coefficients are multiplied by 100 for readability. The figures show coefficients and 95 percent confidence intervals for the days of April 17 through April 28. The full set of coefficients for all days is given in Appendix Figure A4. Panel A restricts the sample to those under age 20 on Earth Day and panel B includes all respondents.

Panel A shows a large and statistically significant effect for rainfall on one day, Earth Day. Precipitation on this day is related to greater opposition to environmental spending by respondents 7 to 23 years later. The coefficient in Panel B is smaller and marginally significant, showing that the effect of good weather on Earth Day is stronger for those under age 20.

The multiplied-by-100 coefficient in panel A is about 0.13, and as noted earlier the mean of the dependent variable is 1.5 with standard deviation .65. For increased rainfall on Earth Day of 100 tenths of a milliliter, or 0.39 inches, the average change in this index would be an increase of about 0.13, or one tenth of the mean. Put differently, a one-standard-deviation increase in precipitation (50 tenths of a millimeter) corresponds to roughly a 0.1 standard-deviation increase in opposition to environmental spending. Alternately, in the Appendix (Appendix Table A3) we show that being older at the time of the survey leads to more anti-environmental attitudes, and the effect of a one-millimeter increase in precipitation on Earth Day is similar to the effect of aging one year. These different interpretations suggest that the effect of Earth Day is modestly sized but nontrivial.

Table 1 shows results from estimating equation (1) under a number of alternate specifications, measures of environmental support, and samples. The first row presents results using deviation-from-historical-norm precipitation which for brevity the table simply calls "rain." Unlike the estimates in Figure 1, here only weather on April 22 is included. The second row redoes the baseline specification but uses simple precipitation r_c rather than its deviation from the historical mean. The third row redoes the baseline estimation but adds extra control variables (coefficients for controls are reported in Table A3). Row 4 uses winsorized deviation-from-historical-average rain using the 5% and 95% values for winsorizing, and also includes extra RHS controls. By using winsorized rainfall, the results investigate whether the effect of Earth Day is driven by outliers that received far-from-normal weather, or by more general patterns. The last row uses a logistic regression for the GSS survey responses for the first two columns and an ordered-logit regression in the last-two columns. These coefficients are the changes in log odds (again times 100). Log-odds ratios for the under-age-20 logistic estimations are given under the table. In the first two columns, the dependent variable is a dummy for whether people say that we are spending too little on the environment. The last two columns use the overall opposition index used in Figure 1. As in Figure 1, coefficients are multiplied by 100 for readability.

The table consistently shows a strong effect for those under age 20 on the original Earth Day, where higher precipitation leads to lower support for environmental spending later. Notably, winsorizing the data makes the results stronger, suggesting our estimates are not driven by a small set of extreme values. The results are driven by those who were under age 20 on Earth Day. The implication is that Earth Day's power to generate variation in environmental opinion (or at least *relative* variation within a year of the survey) based on weather exposure seems strongest for those who were school-aged at the time Earth Day was observed.

In the Appendix we present further evidence on Earth Day and environmental opinion. First, Appendix Figure A4 presents results from the first panel of Figure 1 showing all days in April 1970 as well as presenting results for our other outcome variables that we discuss next. Second, Appendix Figure A5 explores the effects of age on Earth Day further by adjusting the maximum age in the GSS sample one year at a time. The picture shows that the regression estimates are strongest when the sample is limited to school-aged children. Third, Figure A6 presents nonparametric estimation of rainfall and environmental support, relaxing the assumption that this relationship is linear. The estimates are qualitatively similar to those shown here.

Lastly, Appendix Section 3 describes alternate estimates of Earth Day and preferences using data on donations to the League of Conservation Voters. The data is limited to large donations reported to the government, and these results can be imprecise and sensitive to specification. But the point estimates suggest that good weather on Earth Day increases donations to the LCV in the following decades. Altogether, it appears that Earth Day had long lasting effects on individuals' opinions. We turn next to our estimates on air pollution and child health.

5. Earth Day, Air Pollution, and Child Health

Figure 2 Panel A shows the day-by-day effect of Earth Day and other days from April 1970 on carbon monoxide levels.[8] The figure is constructed analogously to Figure 1 earlier, showing coefficients for deviation-from-historical-average precipitation ("rain" for short) for various days in April 1970 and parts-per-million of CO in the atmosphere from 1970 to 1988.

As before, one days stands out, Earth Day. Communities that saw greater-than-average rainfall on Earth Day see more carbon monoxide in their air over the next 20 years. In this regression sample (limited to counties with CO data) a standard-deviation increase in precipitation is ≈ 25 tenths of a millimeter, suggesting a one-standard-deviation increase in rain is associated with an increase in CO in the atmosphere of $25 \times .0046 = .115$ parts per million, which is .085 standard deviations of CO. During the period of the sample, average CO in the atmosphere declined by about 3 parts per million; the standard-deviation-in-rain effect is about one thirtieth this general decline in CO. As before, the effect is modest in size but not negligibly small.

We return to results on CO momentarily but first consider Panel B of Figure 2, with day-by-day results on congenital malformations. The results show that bad weather on Earth

[8] Appendix Table A4 shows results on other air pollution but as noted earlier, and as expected, we see no effect.

Day is associated with more congenital abnormalities 10 to 20 years later. The coefficients are multiplied by 100, so that an increase of 100 tenths of a millimeter in rain on Earth Day increases the probability that a child is born with a congenital abnormality by 0.003. The effect of a one-standard-deviation increase in rain is roughly one-tenth the size of the effect from living near a landfill as estimated in Elliott et al. (2001). Alternately, a 1 s.d. increase in rain increases the fraction born with congenital abnormalities by 0.15 standard deviations.

Table 2 presents results on CO and congenital abnormalities akin to Table 1. Residuals are clustered by state. The first column looks at CO levels, and finds consistent evidence that across our measures of precipitation there is a relationship between more rain on April 22, 1970, and more CO in the air in the next 20 years. As before, the magnitudes are slightly smaller than in the day-by-day figure: controlling for other rainfall makes the coefficient slightly *larger* than the more conservative numbers here.

The last three columns report regressions with congenital abnormalities as the dependent variable and break the results out by SES of the mother (as defined below the table). We find consistent effects of precipitation on the original Earth Day on the risk of congenital abnormalities 10 to 20 years later. This represents a novel example of how the benefits of environmental action can endure absent a fetal-origins type of argument; the cohorts here were of course not even alive on Earth Day. Looking at the last two columns, most of the estimates give larger point estimates to low SES groups, but we take this as suggestive evidence. One might wonder whether this indicates a *proportional* difference in abnormalities by SES, but as noted under the table, the incidence of abnormalities is similar for the two groups, so that the proportional effects are similar or perhaps slightly higher for low SES women. The results are similar using rain in levels instead of residualized deviation-from-mean rainfall in row 2, using extra controls in row 3, using weights (population weights for CO and total births for congenital abnormalities) in row 4, or when using winsorized rainfall in row 5.

The Appendix provides several extensions to these results. In Table 2 we have finer (county) level data than with the GSS, but we cluster our standard errors by state, allowing for residuals within states and over time to be related arbitrarily. We report county-clustered standard errors in Appendix Table A5. The CO errors are similar from both approaches but the county-clustered SEs are somewhat smaller for the congenital abnormalities results, thus the results shown in Table 2 are more conservative. In Appendix Table A6, we report estimates on fetal deaths. These results are similar and suggest that bad weather on Earth Day is associated with more fetal deaths 10 to 20 years later, but these estimates are more sensitive to our choice of clustering method.[9] One might also wonder whether the imposition of a linear relationship between weather and outcomes is appropriate. The winsorization results in Tables 1 and 2 touch on this issue, but as mentioned earlier Appendix Figure A6 presents nonparametric estimates and those estimates are qualitatively similar to the results here.

Our results show a long term effect from Earth Day. Can we characterize the dynamics of this effect? Of the outcomes discussed, our CO data is available consistently over our entire period, so here we investigate whether and how our CO estimates change over time. Figure 3 shows the results from from regressing carbon monoxide (CO) levels on deviation-from-historical-norm precipitation on the original Earth Day. Each coefficient is from a separate regression analogous to the regression in column 1, row 1, of Table 2, except that in each regression here we limit the sample to a single year. We omit the years before 1973 as their confidence intervals are extremely imprecise and affect the scale of the picture (but these intervals are given under the table).

Figure 3 shows point estimates that gradually decline in the late 1970s and then moderate

[9] We also considered low birthweight as an outcome, but these estimates are often insignificant, small, and/or "wrong-signed". For example, doing our main specification in Table 2 with all controls (as in row 3) on the fraction born weighing less than 1500 grams produces coefficients (multiplied by 100) of .00023 (se = .00020), -.00052 (.00040), and .00002 (.00014) for all, high SES, and low SES women respectively. This may be driven by a harvesting effect since we have some evidence of an increase in fetal deaths. These null findings are similar to some but not all of those in prior work on the environment and child health, e.g., Currie and Neidell (2005) find a significant relationship between CO pollution and infant mortality but find no effect of CO on birthweight. Overall, we do not have robust evidence relating Earth Day to birthweight.

in the 1980s. Notably, however, the effects only become statistically significant starting several years after Earth Day. This suggests that studies of the efficacy of voluntary action should consider carefully the potential for mid- or long-term effects even when there are no significant short-term effects. One explanation for this result is that those whose opinions changed the most from Earth Day (students) needed time to reach an age where their decisions (e.g., driving) are consequential for CO.[10] Also, for individuals of any age there are likely frictions that could introduce some time lag in making decisions that matter for air pollution.[11] But a critical takeaway is that the effects of voluntary activity may be very long lasting, and further may become visible only several years after the activity takes place.

Conclusion

In this paper we show that ordinary people, taking purely voluntary actions, can on a single day come together to collectively alter the the values, cleanliness, and health of their communities for years to come. We show that this happened on April 22, 1970. These results not only provide novel evidence on the power of ordinary people to make a difference, but they also change the story of Earth Day itself, showing that Earth Day had previously-unnoticed, highly-local, enduring impacts. These results however do not refute the importance of Earth Day in promoting national change through (e.g.) the adoption of federal policy. Accounting for these national benefits, which our local estimates do not include, would make the social benefits of Earth Day greater still. Applying the approach here to other large scale voluntary events represents an excellent idea for future research.

[10]This explanation would suggest that the dynamics for other outcomes, such as pro-environmental views, could be different, but as our GSS data begins in 1977 we cannot test that possibility here.

[11]Dynamics could also be influenced by individuals responding differently to technological changes, such as the introduction of the catalytic converter in the mid 1970s, which reduced CO emissions from automobiles.

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Appendix

Section 1. Weather on Earth Day and Voluntarism

1a. 1973 Youth Socialization Survey

The 1973 Youth Socialization Survey is the only study we know of which directly asks a national sample of young adults (or other adults) about voluntarism in 1970. This survey is from the Youth-Parent Socialization Panel Study, 1965-1973. These data are taken from the Inter-university Consortium for Political and Social Research(ICPSR).

Students were chosen in 1965 from a national probability sample of ninety-seven secondary schools (including 11 non-public schools). Within each school, 15-21 randomly-designated seniors were interviewed. The sample is thus nationally representative for high-school seniors in 1965. A total of 1348 (80.8 percent of the original sample) were re-interviewed in 1973 (one part of the data documentation says that the followup instead occurred in 1975, we believe this to be erroneous, cf. Jennings and Niemi, 1978). The sample is unweighted. Respondents were asked, "Have you ever taken part in a demonstration, protest, march or sit-in" and if they answered yes were asked to give examples. The dataset includes the time period of each of the first two examples named. The survey also asks about type of activity but we found this hard to parse given many categories and the holistic nature of many Earth Day events; we viewed time as cleaner. If respondents named participation in other non-Earth-Day events from 1970 and the tendency to do this was unrelated to the weather, it would likely bias us towards zero.

We take as our dependent variable a dummy that equals unity if a respondent reports participating in a demonstration/protest in 1970 and zero otherwise. A total of 48 respondents report participating in a 1970 event. We might expect more to have participated in Earth Day; the low number reported could be driven by people instead reporting events in other years (a total of 159 respondents list participation in events in other years but not 1970). If people participated in Earth Day but do not recall doing so for this question (e.g., they do not consider their participation to have been a demonstration or protest) that will bias estimates towards zero if such non-recall is unrelated to the weather. If people who participated in Earth Day events during *bad* weather are especially likely to recall this when answering this retrospective question, that bias will work *against* our results.

For location, we use the Primary Sampling Unit of respondents in the 1965 wave of the survey. PSUs are coded as SMAS or counties (the only exception is Toledo, Ohio, which we code as Lancaster county). For SMSAs, we make population-weighted averages of rainfall and our other county-level controls as we do for our GSS estimates (as discussed in more detail in Appendix Section 2). We also include a dummy for gender, a dummy for whether a respondent is white, the respondent's age, and a dummy for attending some college (it appears that the 1973 survey does not ask about high school completion, perhaps assuming that all seniors interviewed in 1965 graduated).

Table A1 reports estimates from regressing the likelihood of participating in a 1970 demonstration/protest on rainfall on Earth Day. Coefficients are multiplied by 100 for readability; the logistic coefficient is a log-odds coefficient. The first row is the baseline estimate of participation on deviation-from-mean rainfall and individual controls. The second row uses simple precipitation rather than deviation-from-mean. The third row redoes the baseline estimation with extra control variables (those in Appendix Table A2), row 4 uses winsorized precipitation. Row 5 uses a logit on the baseline specification. The last row redoes the baseline but now the dependent variable is participation in years other than 1970.

Most coefficients are negative and significant, indicating that that rain on April 22, 1970 is subsequently negatively associated with individuals reporting participation in a demonstration or event that year. Noting that the coefficients are times 100, the magnitude suggests that a 50-tenths-of-a-millimeter increase in rain lowers reported participation by 1 percentage point. The logit regression similarly suggests that such an increase in rain would lower the odds of participation by about $e^{(50 \times -.00974)} \approx .6$, an effect off of a base of about .03 to $.03 \times .6 \approx .018$. In contrast, rain on that day *increases* the likelihood that a person reports participating in an event some *other* year; this coefficient is large but less precise than some of the main results. We take the results of this table as suggestive, since (a) the table shows that the estimate is sensitive to specification and (b) the data come from a small sample. But the results indicate that, as one would expect, bad weather on Earth Day is associated with lower participation. In the next subsection we turn to the CPS, which uses a much larger sample.

1b. CPS Volunteer Supplement

Large-sample measures of voluntarism are available from the CPS Volunteer Supplement from 2002-2014 administered in September of each year by the US Census Bureau. We obtain these data from the Inter-university Consortium for Political and Social Research (ICPSR).The survey asks questions regarding participation in volunteer activities, defined as unpaid activities through or for an organization at any point in the previous year. They specifically word the question: "Since September 1st of the Last Year, have you done any volunteer activities through or for an organization?" If the participant answers yes, they are asked a series of questions about the type and amount of time spent on activities they engaged in.[12] Respondents were allowed to list up to seven organizations and could list the

[12]Note that there is also a second question regarding whether or not a respondent has volunteered, as some people may not think what they did counted as volunteer activity. The second question asks: "Sometimes people don't think of activities they do infrequently or activities they do for children's schools or youth organizations as volunteer activities. Since September 1st of last year, have you done any of these types of

same type of organization more than once. The organization type of interest is classified as "Environmental or Animal Care Organization." This coding, and the large size of the CPS, allow us to focus on environmental voluntarism specifically.

We use two questions specifically to measure environmental voluntarism. First, we construct a binary yes/no variable for whether they volunteered for an environmental organization. Second, for those who volunteered for an environmental organization, we use the question: "How many hours did you do volunteer activities for [an environmental or animal care organization] in the last year?" to construct our measure of total hours spent volunteering. In constructing the hours spent volunteering variable, there are a few considerations. People who reported yes to volunteering for an environmental organization but were missing for how many hours (e.g. not knowing or refusing to answer) are counted as missing, as they presumably spent a non-zero amount of time on environmental volunteering. These amount to about 2% of the observations used in estimation. Moreover, those who reported volunteering but did not list an environmental organization and those who did not volunteer at all were recorded as zeros. Observations are missing if they are "not in universe" or missing for all of the volunteer questions.

There is another question regarding hours volunteering in the volunteer supplement as well. Respondents provided how many weeks they volunteered for the organization they listed, and then were asked how many hours per week they volunteered. The results using this measure of hours are consistent with the previous measure.

Included in baseline regressions are controls for gender, marital status, race, whether the respondent is college educated, whether the respondent belongs to a family with income above the median income in their state for the year of the survey, and year fixed effects. Standard errors are clustered at the county level. The main regressions are weighted by the "Final weight", which adjusts for geographic and demographic subgroups of the population. Results are robust to using the volunteer supplement non-response weight instead, and to

volunteer activities?" This second question may contain responses when the main voluntarism question of interest is answered as no or missing, and is used when constructing our measures of voluntarism.

controlling for temperature.

Figures A1 and A2 show day-by-day results of regressing hours of environmental volunteering on Earth Day rainfall (Figure A1) and a dummy for any environmental volunteering at all (Figure A2). These have a sample size of 422,172 and 425,692, respectively. Unlike the figures in the main text, here the relevant Earth Day rainfall is from Earth Day of the year a respondent was surveyed (in September). The coefficients are multiplied by 100.

Both pictures show that rain on Earth Day is associated with lower levels of voluntarism, while other days in April generally are not. The coefficient in Figure A1 suggests that an increase in 100 tenths of millimeters of rain (2 s.d.s) is associated with a decline of .0134 hours in average volunteering, which would be a decline of about 1,300 hours in total in a community of 100,000 people. Figure A2 indicates that this increase in rain would lower the probability that someone reports being a volunteer by close to .1%, or about 78 people in a town of 100,000. Together both pictures indicate that rainfall on recent Earth Days is associated with lower reports of environmental voluntarism, at both the extensive and intensive margins, when people are surveyed six months later.

Section 2. Additional Information on the GSS

For the General Social Survey, restricted-use Primary Sampling Unit information is available for the samples from 1977 through 1993. We obtained information on the list of primary sampling units from the NORC organization (which oversees the GSS). The documentation provided lists Standard Metropolitan Statistical Areas for the 1970 sample frame (which also includes several counties and county groups). The documentation for the 1980 frame is worse, with several SMSAs misspelled and at least one PSU number apparently mislabeled.

We used both the 1970 and 1980 frames, discarding the Black Sample frame. We matched 1970 information on SMSAs to county level information using SMSA to Census 1970 and 1980 information provided by the US Census. For 1980, we matched data using SMSA name, and if there was no SMSA with a name we matched using the provided county name and state. For both the 1970 and 1980 sampling frames, there are several multi-county groups that are not SMSAs. We constructed SMSA-like groups of counties for these PSUs.

Since our weather data is available at the county level, but SMSAs span counties, we estimated daily precipitation in two ways. First, we used the recorded precipitation from the county with the largest 1970 population in each SMSA. Second, we took a 1970-population-weighted average of precipitation from counties in each SMSAs; the results reported in the paper use this latter measure. However, the correlation in April 22, 1970 precipitation with these two measures was close to 0.99, and results were generally quite similar regardless of which measure we used.

Section 3. Evidence from the Federal Election Commission

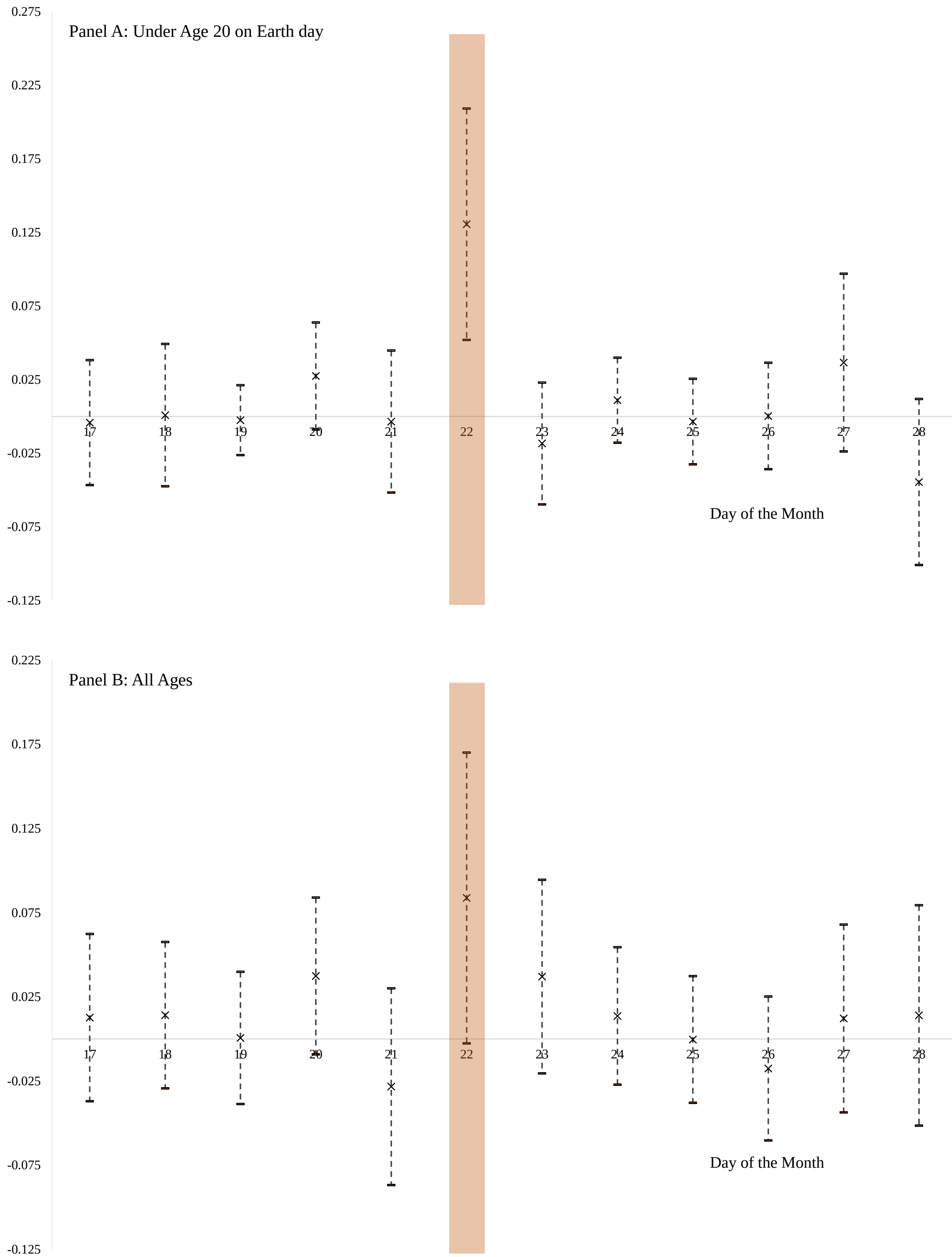
We also look at data on individual contributions to the League of Conservation Voters (LCV) from the Federal Election Commission (FEC) from 1978 to 1988.[13] We choose 1978 as the start date as this is the first year of available data in the relevant time period. The FEC reports all data on contributions over a threshold (for much of this period, $500) and contains zip code level identifiers. We match zip codes to counties and use the total individual contributions within a county as our outcome. We drop observations from zip codes that cross county borders (i.e., not fully contained within a county) and have non-zero contributions, as it is not clear which county generated that data. We have 27,654 observations in this sample.

Table A7 reports population weighted regressions of total contributions on rainfall on Earth Day. Specifications are clustered in different ways. Results are not statistically significant across all specifications; however, the results indicate that more rain on Earth Day decreases individual contributions to the LCV. The mean and standard deviation of total contributions are 43 and 827 dollars, respectively. The estimated coefficient on the specification with residual rain and controls then implies that a one standard-deviation increase

[13]Data available at: `https://www.fec.gov/`. We use committee ID C00094870, which is the LCV PAC with data available over this time range.

in residual rainfall on Earth Day leads to a 110 dollar, or .13 standard deviation, decrease in contributions. Figure A7 presents day-by-day estimates as in the main text. Again, the point estimates suggest that higher rain lowers donor support for the LCV, but the result is not statistically significant, while a few of the other coefficients, spuriously, are. Overall, we take Table A7 and Figure A7 as suggestive, but not conclusive, evidence that Earth Day affected support for the LCV. However, the results here are necessarily limited to only the largest donations, as only large donations are reported to the FEC.

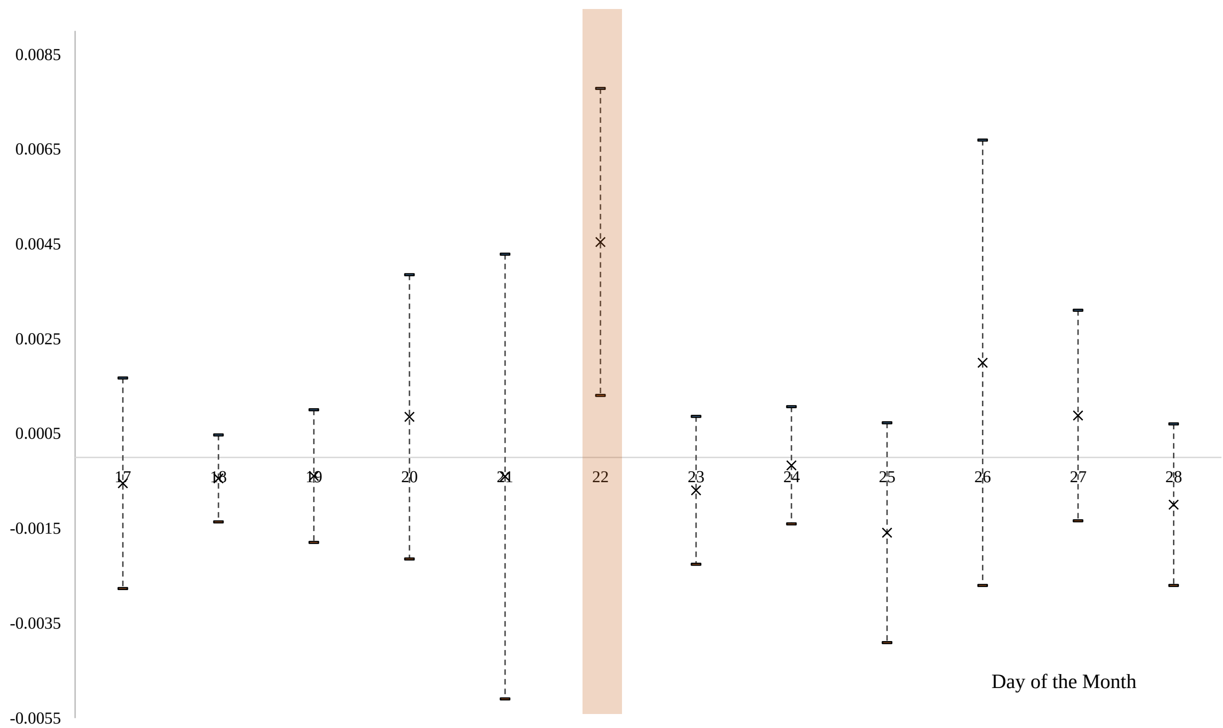
Figure 1: Opposition to Environmental Spending in the 1970s and 1980s and April 1970 Rainfall



Each picture shows coefficients and 95% confidence intervals from a regression on agreement with the statement "we're spending too much money" on improving & protecting the environment on a set of covariates for rainfall on days in April, 1970. Responses are taken from the 1977 through 1993 waves of the General Social Survey. Coefficients are multiplied by 100 for readability. The estimation is based off of the baseline specification in Table 1. The full set of results is given in the appendix. 95% confidence intervals are shown around each coefficient.

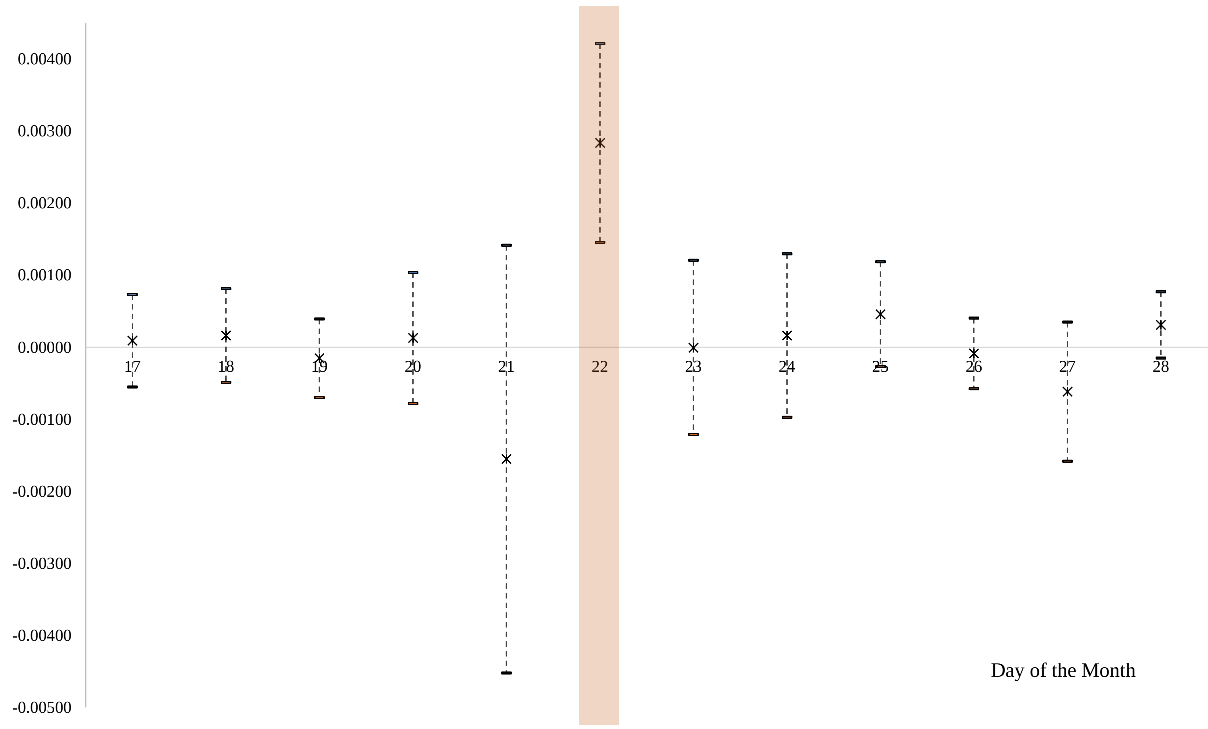
Figure 2: Earth Day, Air Pollution, and Infant Health

Panel A: Mean CO Readings and April 1970 Rainfall



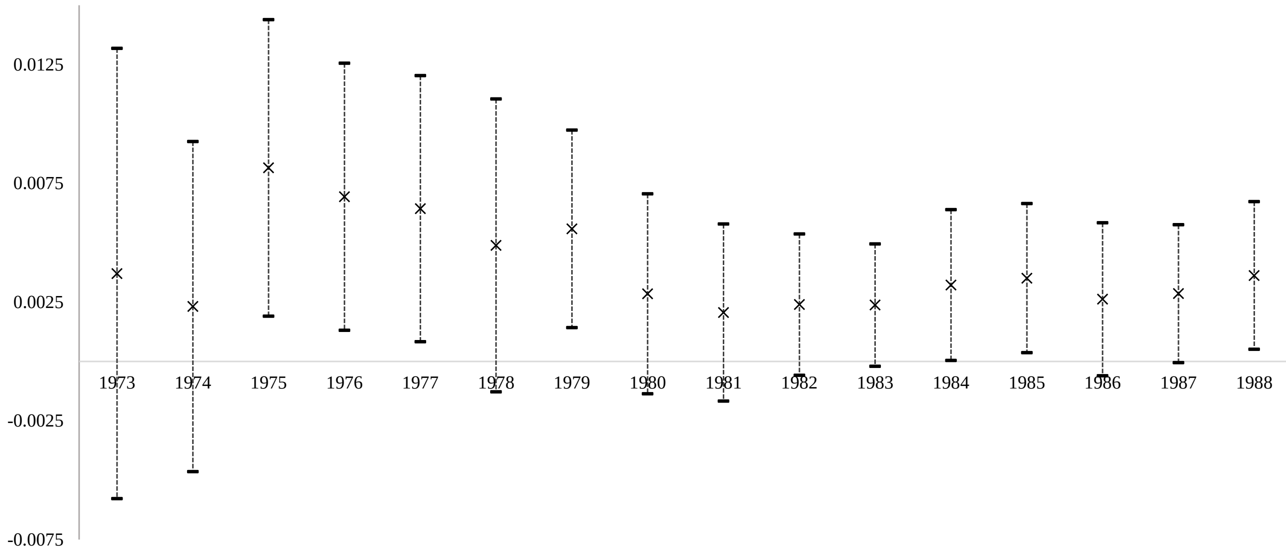
This picture shows coefficients and 95% confidence intervals from a regression of annual CO levels (1970-1988) on a set of covariates for rainfall on days in April, 1970.

Panel B: April, 1970 Rainfall and Congenital Malformations



This picture shows coefficients and 95% confidence intervals from a regression of births with congenital malformations, from 1980-1988, on a set of covariates for rainfall on days in April, 1970. Coefficients are multiplied by 100 for readability.

Figure 3: The Effect of Earth Day on CO Over Time



The figure shows coefficients and 95% confidence intervals from regressing carbon monoxide (CO) levels on deviation-from-historical-norm precipitation on the original Earth Day. Each coefficient is from a separate regression analagous to the regression in column 1, row 1, of Table 2, except that in each regression here we limit the sample to a single year. The years before 1973 are omitted as their confidence intervals are large and distort the axis (the 1970 CI is {-0.067, 0.013}, for 1971 it is {-0.012, 0.021}, and for 1972 it is {-.0046, 0.016}).

Table 1: Rainfall on April 22, 1970, and Environmental Support in the 1970s and 1980s

	Strongest Support for Environment Spending		Opposition to Environment: Overall Index	
	All Ages	Under 20 on Earth Day	All Ages	Under 20 on Earth Day
	(1)	(2)	(3)	(4)
Rain on Earth Day	-0.046*	-0.0854***	0.0576	0.0976**
	(0.000272)	(0.032)	(0.036)	(0.042)
Rain on Earth Day (Levels)	-0.0572*	-0.0839**	0.0617	0.0932**
	(0.032)	(0.038)	(0.043)	(0.047)
Rain on Earth Day (Extra Controls)	0.0156	-0.0671**	-0.0208	0.0757*
	(0.024)	(0.032)	(0.032)	(0.040)
Winzorized Rainfall	0.0155	-0.0828**	-0.0264	0.0977*
	(0.032)	(0.040)	(0.044)	(0.051)
Logistic/Ordered Logistic	0.0637	-0.338**	-0.0425	0.334**
	(0.106)	(0.153)	(0.103)	(0.154)

Each coefficient is from a separate regression. Heteroskedasticity-robust standard errors, clustered by primary sampling unit, in parentheses. The data come from the General Social Survey from 1977 to 1993. Coefficients are multiplied by 100 for readability. In the first two columns the dependent variable is a dummy variable that equals 1 if a respondent says "we're spending too little money" on improving and protecting the environment. The last two columns index responses on the current level environmental spending from 1 to 3, where 3 = spending is "too high", 2 = it is "about right", and 1 = "too little". For each dependent variable the first column shows all respondents and the second shows results for those alive and under age 20 on the original Earth Day. There are 18,370 and 5,161 observations in the baseline regression in these respective columns. The mean of the index is 1.5 (sd = 0.65) for the full sample and 1.3 (0.53) for the under 20 sample. The mean of the strongest support dummy is 0.62 (0.49) for the full sample and 0.74 (0.44) for the under 20 sample. All regressions include a set of individual controls (age, education, race, survey form used, year of interview).

For all columns, the first row uses deviation-from-historical-average-precipitation on Earth Day; which for brevity we refer to as "rain on Earth Day". The second row redoes the baseline specification but uses simple precipitation rather than its deviation from the historical mean. The third row redoes the baseline estimation but adds extra control variables (listed in Appendix Table A2), row 4 uses winsorized deviation-from-historical-average rain using the 5% and 95% values for winsorizing, and also includes extra RHS controls. The last row uses a logistic regression for the GSS survey responses for the first two columns and an ordered-logit regression in the last-two columns. The logistic regressions are reported in log odds (multiplied by 100 for readability). The corresponding, not-multiplied-by-100 odds ratio coefficients for columns 2 and 4 are .99662 (se = .0015) and 1.00335 (.0015). * = significant at the 10 percent level, ** = significant at the 5 percent level, *** = significant at the 1 percent level.

Table 2:
Rainfall on April 22, 1970, and Carbon Monoxide & Congenital Abnormalities in the 1970s and 1980s

	Carbon Monoxide	Congenital Abnormalities† All	Congenital Abnormalities† High SES Births	Congenital Abnormalities† Low SES Births
	(1)	(2)	(3)	(4)
Rain on Earth Day	0.00360**	0.00514***	0.00525***	0.00515***
	(0.00158)	(0.0011)	(0.0010)	(0.0012)
Rain on Earth Day (Levels)	0.00355*	0.00408**	0.00348**	0.0028
	(0.00191)	(0.0018)	(0.0016)	(0.0025)
Rain on Earth Day (Extra Controls)	0.00320**	0.00368***	0.00326***	0.00438***
	(0.00145)	(0.0012)	(0.0011)	(0.0012)
Rain on Earth Day (Extra Controls, Weighted)	0.00347*	0.00426**	0.00451**	0.00649**
	(0.00190)	(0.0021)	(0.0018)	(0.0025)
Winzorized Rainfall	0.00390**	0.00546*	0.00633**	0.00876**
	(0.00167)	(0.0030)	(0.0027)	(0.0034)

†The coefficients and standard errors in columns 2, 3, and 4 are multiplied by 100 for readability.

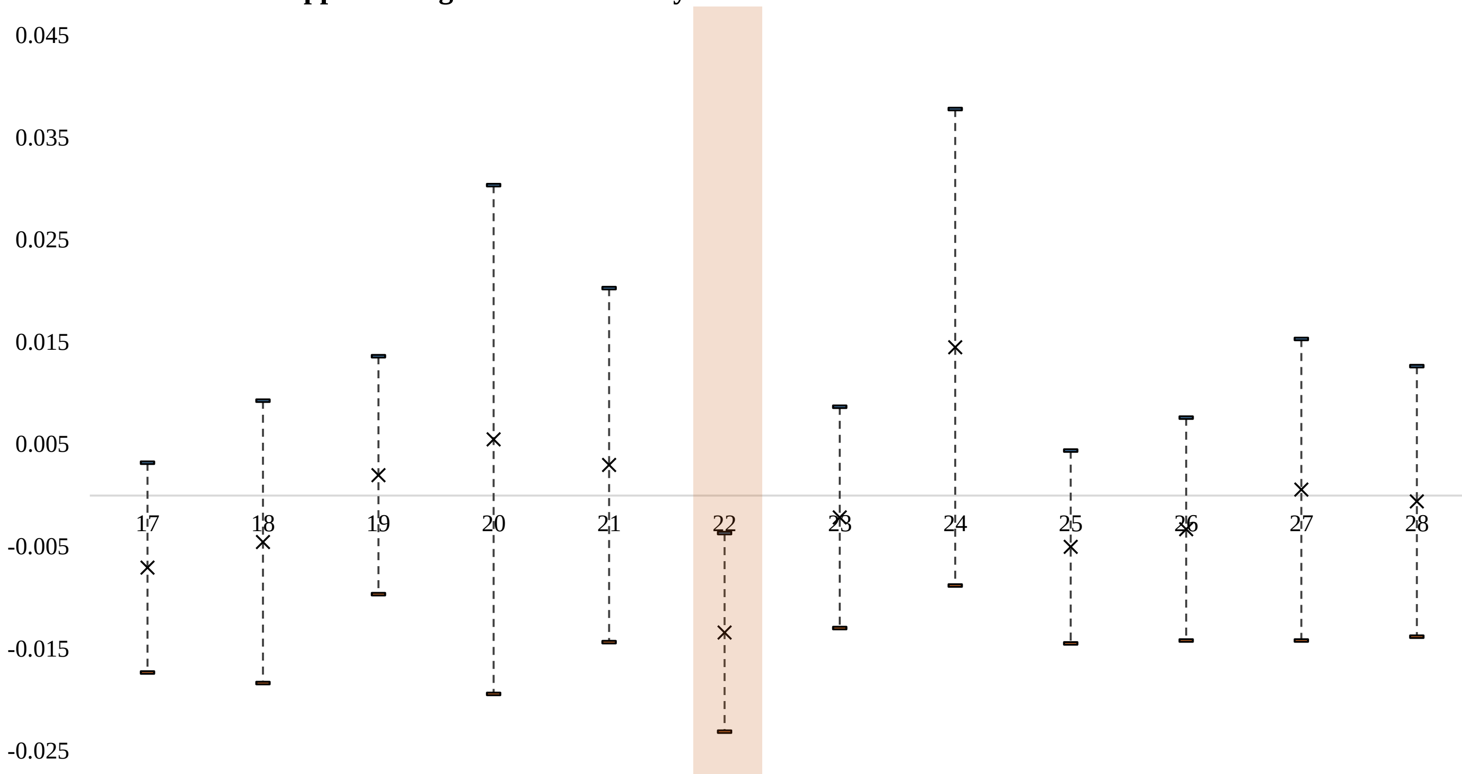
Each coefficient is from a separate regression. Heteroskedasticity-robust standard errors, clustered by state, in parentheses. In column 1, the dependent variable is mean annual carbon monoxide readings (in parts per million) in a county from 1970 to 1988 and the sample includes a total of 3,823 observations. The mean of this variable is 1.757 (se = 1.34). The specifications in each row follow Table 1. As in that table, we refer to deviation-from-historical-average precipitation here as "rain on Earth Day" for brevity.

In columns 2, 3 and 4 the dependent variable is the fraction of children born with a congenital abnormality; these data are available from 1980 to 1988, with a total sample size of 25,691. Column 3 restricts the sample to births from high socioeconomic status (SES) mothers and column 4 restricts the sample to low SES mothers, where low SES women are one of the following (a) teenaged (b) unmarried (c) nonwhite, and high SES mothers are all others. The (weighted) fraction of congenital abnormalities for all women, high SES women, and low SES respectively is 0.01 (sd = 0.009), 0.01 (0.008), and 0.01 (0.011).

The first three rows use unweighted data. In the fourth row, we weight the estimates on carbon monoxide by the total population in a county, and we weight the congenital abnormality regressions by the number of births. Row 5 includes the extra RHS controls and reports our preferred specification for each dependent variable where carbon monoxide estimates are unweighted and congenital abnormalities are weighted by births; changing the use of weights produces similar results.

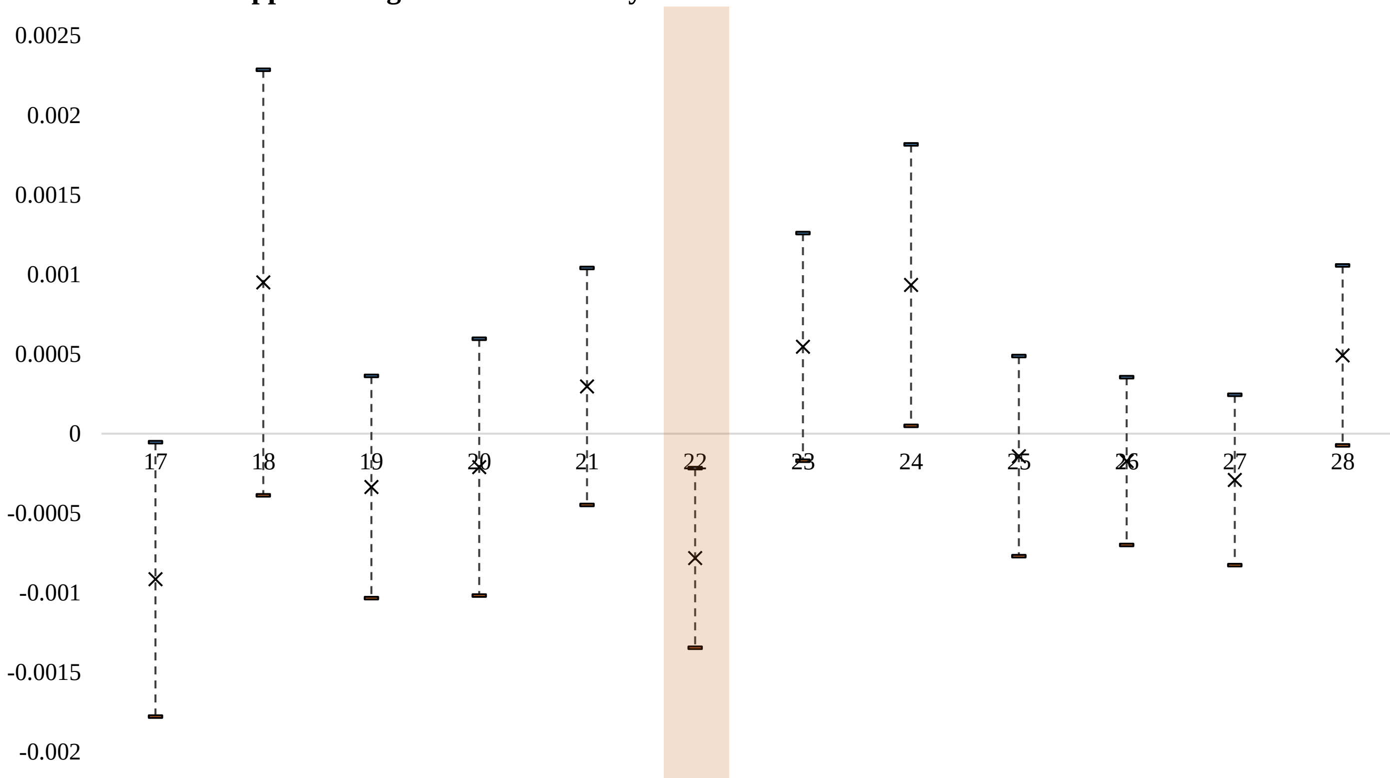
* = significant at the 10 percent level, ** = significant at the 5 percent level, *** = significant at the 1 percent level.

Appendix Figure A1: Earth Day Rainfall and Environmental Voluntarism



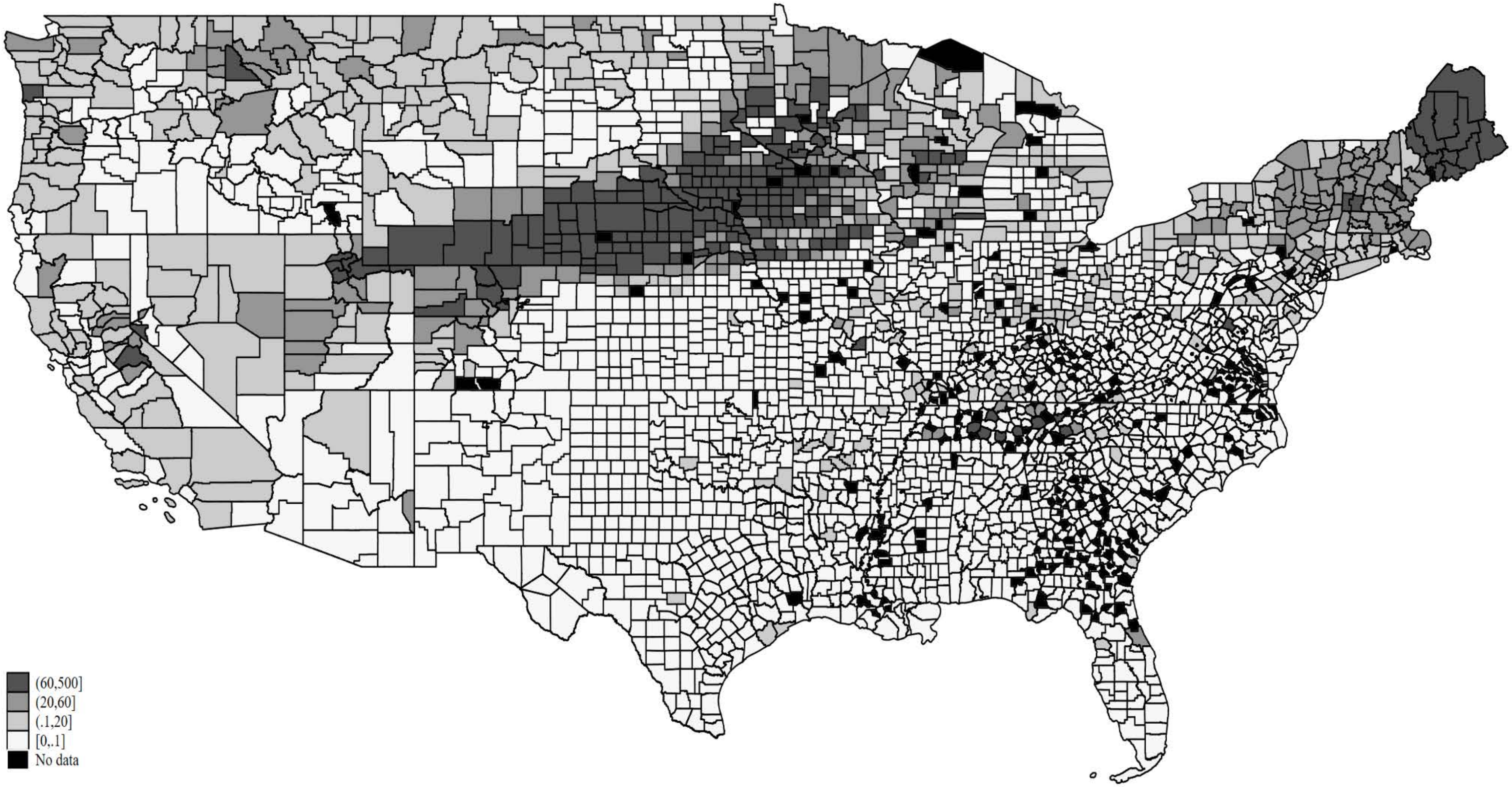
This picture shows coefficients and 95% confidence intervals from a regression of annual hours spent volunteering for an environmental (or animal care) organziation on a set of covariates for rainfall on days in April from 2002 to 2014. The regression also includes a set of controls. Coefficients are multiplied by 100.

Appendix Figure A2: Earth Day Rainfall and Environemtnal Voluntarism



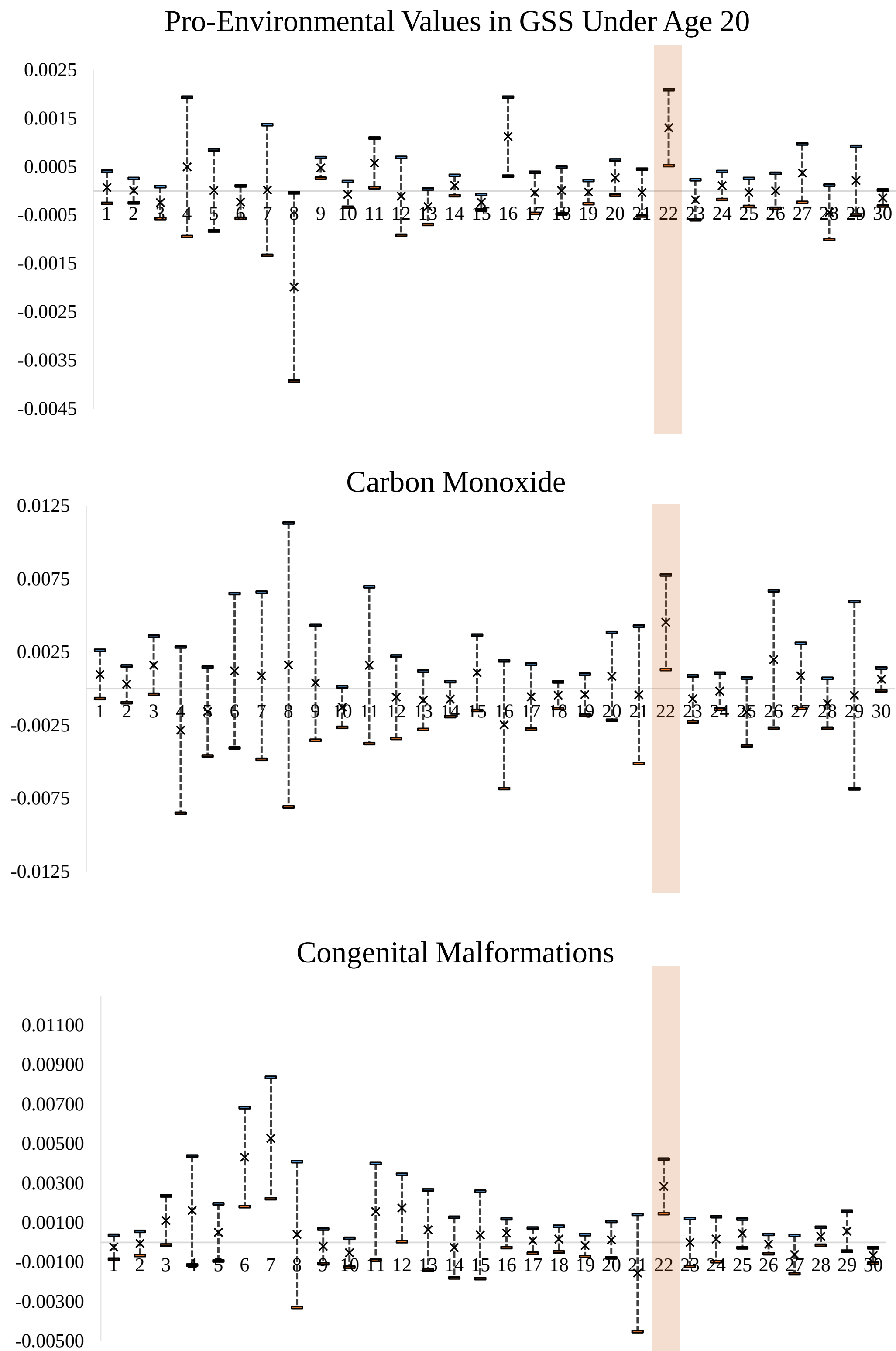
This picture shows coefficients and 95% confidence intervals from a regression of an indicator for volunteering for an environmental (or animal care) organziations on a set of covariates for rainfall on days in April from 2002 to 2014. The regression also includes a set of controls. Coefficients are multiplied by 100.

Appendix Figure A3: Precipitation on April 22, 1970



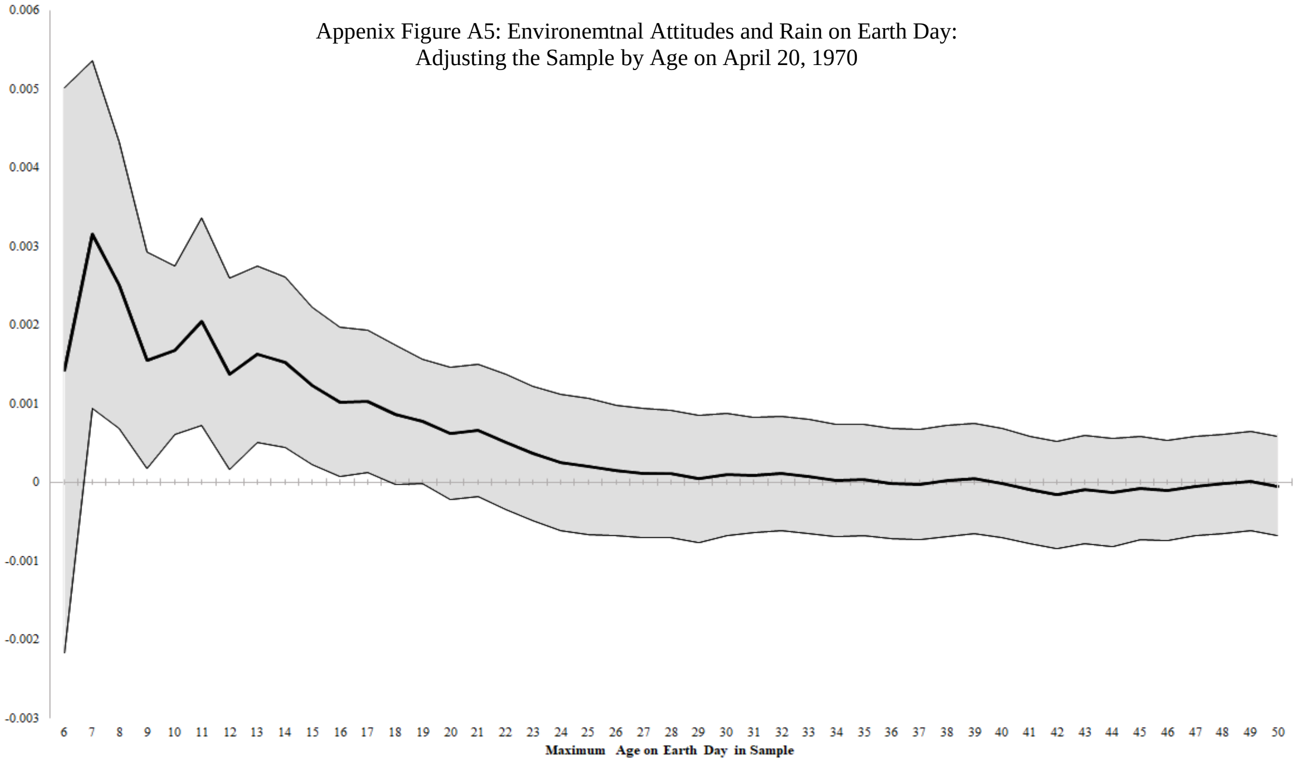
Rainfall is measured in .1mm.

Appendix Figure A4: Daily Rainfall Estimates, All Days in April 1970



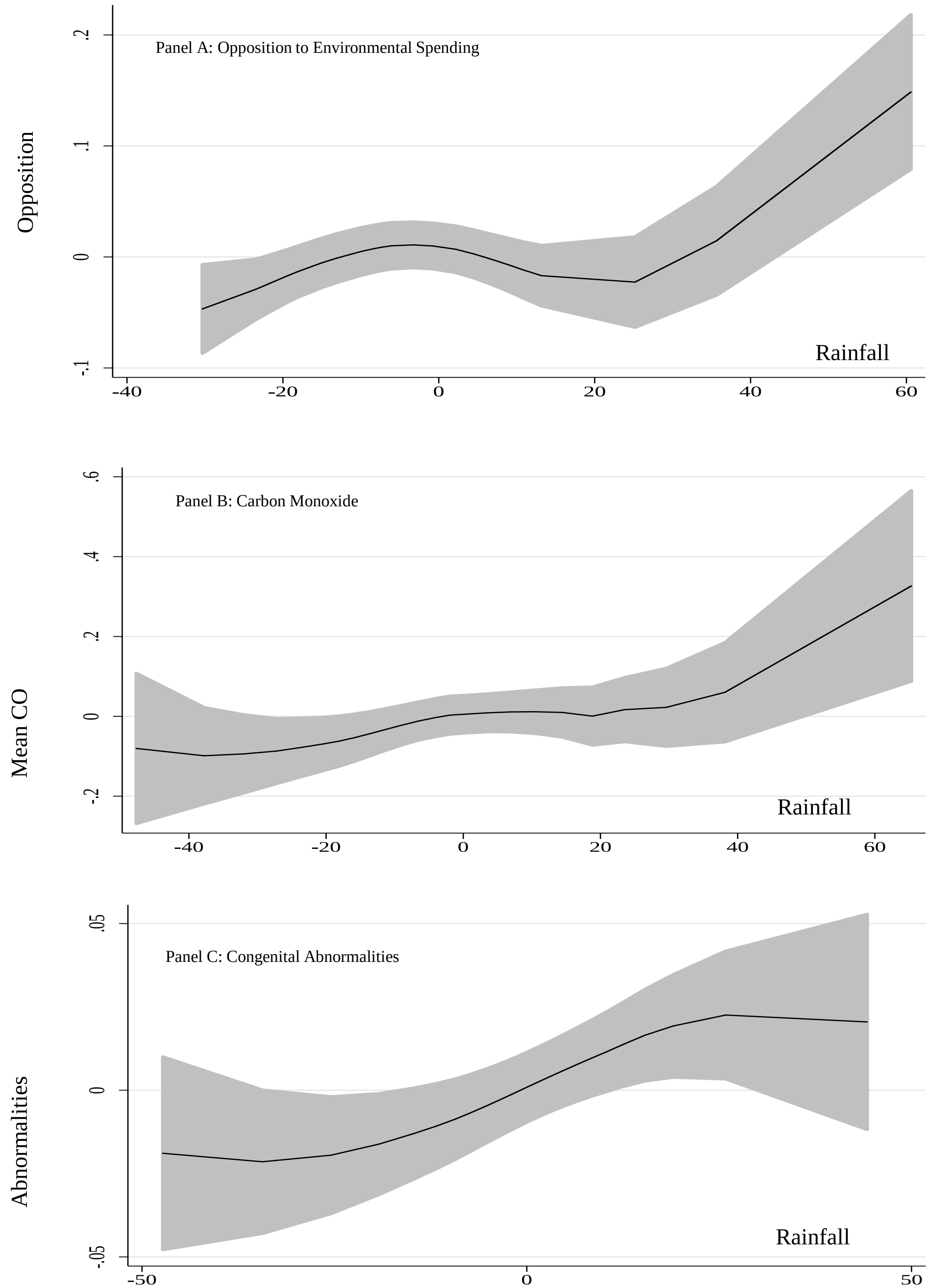
This figure depicts results from three regressions, one for each of the three panels. Each panel shows the results of a regression on a given outcome on rain each day in April 1970. The panels correspond to the figures in the main text.

Appenix Figure A5: Environemtnal Attitudes and Rain on Earth Day:
Adjusting the Sample by Age on April 20, 1970



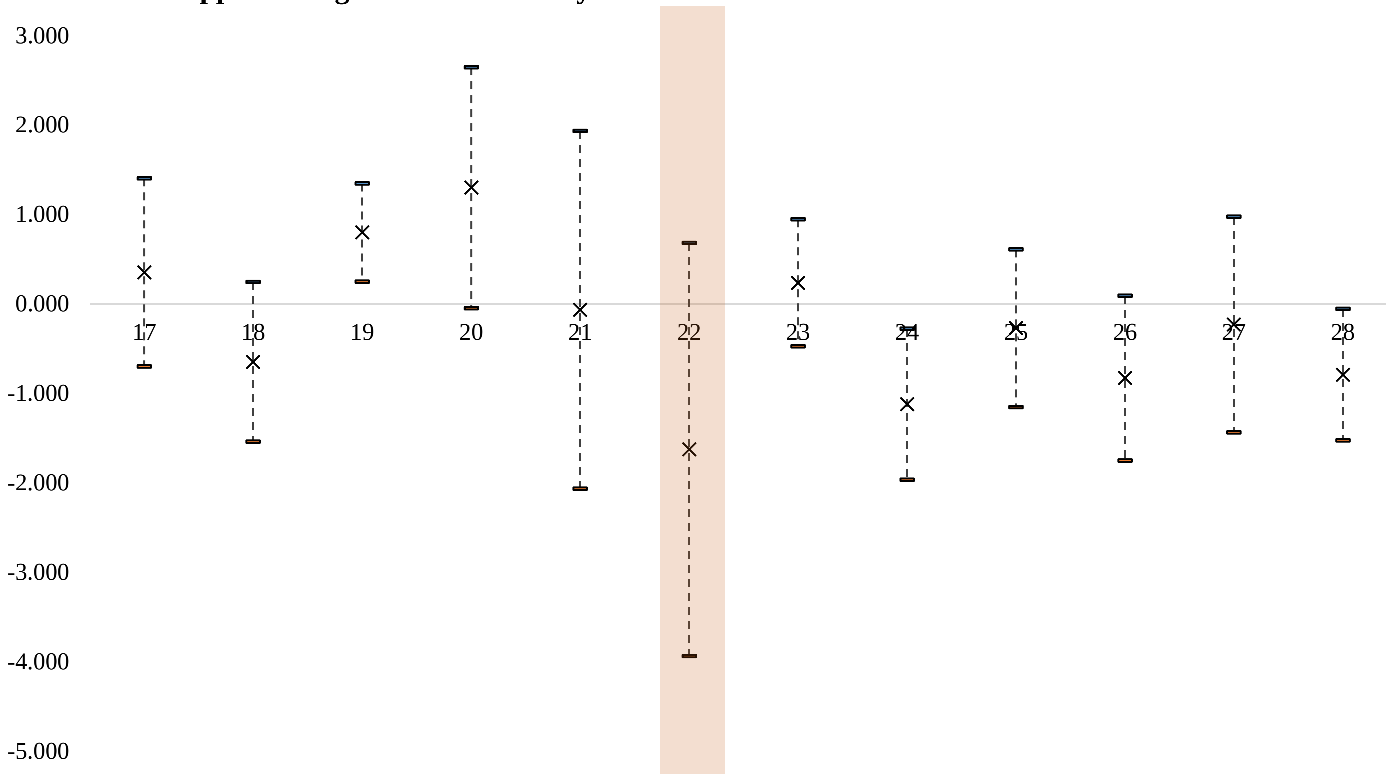
The figure shows the results from 45 estimated regressions. Each regression regresses stated opposition to environmental spending on original-Earth-Day rainfall and a set of controls. The regressions limit the sample by age on earthday to individuals between age 5 and the given age on the x axis. (Results including just those under age 5 are typically imprecise). The black line shows the coefficient estimate, and the grey area shows the 95 percent confidence interval as progressively older ages are included in the sample.

Appendix Figure A6: Earth Day Rainfall and Later outcomes: Nonparametric Estimates



Each panel shows a local polynomial estimate, with 95% confidence intervals, of the relation between rainfall on April 22, 1970, and (in panel A) opposition to environmental spending among those under 21 in the 1977 through 1993 General Social Surveys (in panel B) mean annual Carbon Dioxide levels in counties from 1970 to 1988 and (in panel C) logged congenital abnormalities from 1980 to 1988. In all panels both the dependent variable and residual rainfall are residualed out from a set of observables, and then fifth-degree polynomials are estimated at each 5th percentile of the sample using an optimal bandwidth that is separately determined in each panel.

Appendix Figure A7: Earth Day Rainfall and Individual Contributions to the FEC



This picture shows coefficients and 95% confidence intervals from a regression of the total county level individual contributions to the FEC on rainfall. The regression also includes a set of controls.

Appendix Table A1: Earth Day Weather and Voluntarism: Evidence from the 1973 Youth Socialization Study

	Participated in Demonstration in 1970
(1) Rain on Earth Day	0.00214
	(0.0168)
(2) Rain on Earth Day (Levels)	-0.0185*
	(0.0109)
(3) Rain on Earth Day (Extra Controls)	-0.0208*
	(0.0108)
(4) Winzorized Rainfall	-0.0207
	(0.0219)
(5) Logistic/Ordered Logistic	-0.974**
	(0.4200)
(6) Demonstrated in Other Years	0.0566*
	(0.0289)

In all rows coefficients are multiplied by 100 for readability; the logistic regressoin reports log-odds. Each coefficient is from a separate regression. Heteroskedasticity-robust standard errors, clustered by primary sampling unit, in parentheses. The data come from the 1973 Youth Socialization Study. There are 1313 respondents in the sample. In the first 5 rows the dependent variable is a dummy that equals 1 if a respondent reports having ever participated in a "demonstration, protest march, or sit-in" in 1970 (48 respondents report this, the mean is thus 0.0366). The last column is a dummy for whether a respondent reports participating in a demonstration, protest march, or sit-in in other years (159 respondents report this).

The first row uses deviation-from-historical-average-precipitation on Earth Day; which for brevity we refer to as "rain on Earth Day", and individual controls for age, education, and race. The second row uses uses simple precipitation rather than its deviation from the historical mean. The third row redoes the baseline estimation but adds extra control variables (listed in Appendix Table A2), row 4 uses winsorized deviation-from-historical-average rain using the 5% and 95% values for winsorizing, and also includes extra RHS controls. The fifth row redoes row 3 using a logit regression rather than OLS. The last row uses the baseline specification from row 1. * = significant at the 10 percent level, ** = significant at the 5 percent level, *** = significant at the 1 percent level.

Appendix Table A2: Control Variables

	Variable mean, [std dev]	Regression on Rainfall β, (s.e.)		Variable mean, [std dev]	Regression on Rainfall β, (s.e.)
Per capita income in 1969	20957	24	Fraction population in manufacturing, 1970	0.068	0.00058
	[4958]	(179)		[0.057]	(0.00202)
Per capita state unemployment	82	2.596	Fraction population in mining, 1970	0.008	-0.00109
insurance transfers in 1970	[58]	(3.122)		[0.021]	(0.00079)
Fraction population employed, 1970	0.409	0.00260	Fraction population black, 1970	0.082	-0.00197
	[.100]	(0.00440)		[0.139]	(0.00179)
Fraction population in poverty, 1970	0.164	-0.00473	Fraction population other race in 1970	0.011	-0.007327**
	[0.095]	(0.00399)		[0.043]	(0.00361)
Average number of air quality monitors	2.89	-0.18602	First population quantile	0.21	-0.02519
	[2.97]	(0.11546)		[0.41]	(0.02323)
Fraction population under age 18, 1970	0.350	0.00036	Second population quantile	0.25	0.00919
	[0.040]	(0.00175)		[0.43]	(0.02472)
Fraction population with HS education, 1970	0.263	0.00052	Third population quantile	0.26	-0.00032
	[0.053]	(0.00230)		[0.44]	(0.01913)
Fraction population married, 1970	0.637	0.005138***	Fourth population quantile	0.28	0.01633
	[0.044]	(0.00176)		[0.45]	(0.01591)
Fraction population female, 1970	0.508	0.00081	Log of 1970 population	10.01	-0.04664
	[0.017]	(0.00078)		[1.31]	(0.05403)

Observations: 2523. For each variable, the left column shows the mean and standard deviation and the right column shows the coefficient and standard error of a regression of the variable on county-level precipitation on April 22, 1970, in .1mm, per day. Each coefficient is from a separate regression. * = 10 percent significant, ** = 5 percent significant, *** = 1 percent significant. A joint test of the significance of the association of all the above variables with precipitation on Earth Day yields F(17, 2522) = 1.12, p = 0.32. The mean quantiles for population do not all equal 0.25 since some counties with missing variables are omitted from the sample and smaller counties are more likely to be omitted. The mean and standard deviation for precipitation is 13.4 [39].

Appendix Table A3: RHS Coefficients

	GSS All	GSS Under 20	Carbon Monoxide	Congenital Abnormalities
Rain on Earth Day	-0.000208	0.000757*	0.00320**	4.26e-05**
	(0.000322)	(0.000396)	(0.00145)	(2.09e-05)
Age	0.00772***	0.00735***	-	-
	(0.000332)	(0.00191)		
High School Education	-0.0533***	-0.0480**	-	-
	(0.0127)	(0.0236)		
Over-HS Education	-0.0990***	-0.0881***	-	-
	(0.0142)	(0.0242)		
Male Dummy	0.0549***	0.0138	-	-
	(0.0100)	(0.0133)		
White Dummy	0.0163	-0.0345	-	-
	(0.0177)	(0.0258)		
Fraction married 1970	-0.0419	-0.0940	-2.105	-0.0123
	(0.280)	(0.363)	(1.860)	(0.0266)
Fraction Black 1970	-0.141	0.0639	-0.163	0.00168
	(0.0965)	(0.139)	(0.820)	(0.00950)
Fraction Other Race 1970	0.155	0.0939	-1.230	-0.00285
	(0.0954)	(0.131)	(1.160)	(0.0119)
UI Transfers in 1970	-0.235**	-0.246	2.944**	-0.0198
	(0.113)	(0.186)	(1.194)	(0.0192)
Fraction Female 1970	0.351	0.324	6.880*	0.0256
	(0.229)	(0.299)	(3.783)	(0.0228)
Fraction under 18 in 1970	0.925***	0.756**	0.771	0.0165
	(0.262)	(0.320)	(2.204)	(0.0183)
Fraction HS 1970	0.248	0.201	-0.815	0.0221
	(0.325)	(0.424)	(2.083)	(0.0266)
Fraction mining 1970	0.772	0.583	0.0139	0.0268
	(0.746)	(0.912)	(5.013)	(0.0210)
Fraction manufactoring 1970	-0.488***	-0.291	-1.273	-0.00671
	(0.163)	(0.225)	(1.335)	(0.0148)
Fraction employed 1970	0.159	-0.0220	1.860***	0.00668**
	(0.117)	(0.165)	(0.506)	(0.00319)
Fraction in poverty 1970	-0.132	-0.107	-4.415	-0.0240
	(0.232)	(0.277)	(2.818)	(0.0165)
Percapita Income	-6.04e-06	-4.55e-06	1.75e-06	-4.32e-07***
	(3.74e-06)	(4.03e-06)	(1.42e-05)	(1.27e-07)

Standard errors in parentheses. The first column matches the specification in column 3, row 2, of Table 1. The second column here matches column 4 row 2 of Table 1. The third column here matches column 1 row 2 of Table 2. The last column here matches column 2 row 2 of Table 2. The first five variables are individual-level controls from the GSS.

* = significant at the 10 percent level, ** = significant at the 5 percent level, *** = significant at the 1 percent level.

Appendix Table A4:
Rainfall on April 22, 1970, and Various Measures of Air Pollution

	NO2	Ozone	TSP	SO	Carbon Monoxide
	(1)	(2)	(3)	(4)	(5)
Rain on Earth Day	-0.0102	9.68e-06	-0.0314	0.00116	0.0036**
	(0.0148)	(8.94e-06)	(0.0250)	(0.00800)	(0.00158)
Observations	3215	5382	18772	4250	3823

Each coefficient is from a separate regression. Heteroskedasticity-robust standard errors, clustered by state, in parentheses. The means and standard errors in each column are 17.2 (se = 9.5) in column 1, .025 (.008) in column 2, 60.6 (24.9) in column 3, 5.4 (7.1) in column 4, and 1.757 (se = 1.34) in column 5.

* = significant at the 10 percent level, ** = significant at the 5 percent level, *** = significant at the 1 percent level.

Appendix Table A5:
Alternate Standard Errors

		Congenital Abnormalities[†]		
	Carbon Monoxide	All	High SES Births	Low SES Births
	(1)	(2)	(3)	(4)
Rain on Earth Day	0.0036	0.0051	0.0053	0.0052
(county cluster SEs)	(0.00140)	(0.0005)	(0.0006)	(0.0006)
(state cluster SEs)	(0.00158)	(0.0011)	(0.0010)	(0.0012)
Rain on Earth Day (levels)	0.00355	0.0041	0.0035	0.0028
(county cluster SEs)	(0.00177)	(0.0010)	(0.0009)	(0.0014)
(state cluster SEs)	(0.00191)	(0.0018)	(0.0016)	(0.0025)
Rain on Earth Day (Extra Controls)	0.0032	0.0037	0.0033	0.0044
(county cluster SEs)	(0.00149)	(0.0006)	(0.0007)	(0.0008)
(state cluster SEs)	(0.00145)	(0.0012)	(0.0011)	(0.0012)
Rain on Earth Day (Extra Controls, weighted)	0.00347	0.0043	0.0045	0.0065
(county cluster SEs)	(0.00180)	(0.0009)	(0.0007)	(0.0011)
(state cluster SEs)	(0.00190)	(0.0021)	(0.0018)	(0.0025)
Winzorized Rainfall	0.0039	0.0055	0.0063	0.0088
(county cluster SEs)	(0.00173)	(0.0012)	(0.0010)	(0.0016)
(state cluster SEs)	(0.00167)	(0.0030)	(0.0027)	(0.0034)

[†]The coefficients and standard errors in columns 2, 3, and 4 are multiplied by 100 for readability. Each coefficient is from a separate regression. Heteroskedasticity-robust standard errors, clustered by either state or by county. Aside from the alternate standard errors, the estimates are the same as those in Table 2; see Table 2 for more details.

Appendix Table A6:
Rainfall on April 22, 1970, and Fetal Deaths in the 1970s and 1980s

	All	High SES Births	Low SES Births
	(1)	(2)	(3)
Rain on Earth Day	0.000127	0.00844	0.00726
(county cluster SEs)	(0.0005)	(0.0040)	(0.0025)
(state cluster SEs)	(0.0019)	(0.0091)	(0.0062)
Rain on Earth Day (levels)	-0.00418	-0.00246	-0.00209
(county cluster SEs)	(0.0022)	(0.0014)	(0.0014)
(state cluster SEs)	(0.0029)	(0.0019)	(0.0017)
Rain on Earth Day (Extra Controls)	0.00299	0.00807	0.0072
(county cluster SEs)	(0.0007)	(0.0065)	(0.0038)
(state cluster SEs)	(0.0025)	(0.0093)	(0.0060)
Rain on Earth Day (Extra Controls, weighted)	0.00257	0.00115	0.00491
(county cluster SEs)	(0.0020)	(0.0012)	(0.0014)
(state cluster SEs)	(0.0041)	(0.0022)	(0.0034)
Winzorized Rainfall	0.00414	0.00198	0.00694
(county cluster SEs)	(0.0029)	(0.0018)	(0.0019)
(state cluster SEs)	(0.0060)	(0.0033)	(0.0048)

Each coefficient is from a separate regression. Heteroskedasticity-robust standard errors, clustered by county, in parentheses. The dependent variable in column 1 is the ratio of fetal deaths to births in a county each year; the years covered include 1982 to 1988. There are 17659 observations in the sample. The specifications in each row and column follow those used in table 2 in the text. Column 2 uses the fetal death ratio of high SES women and column 3 uses the fetal death ratio of low SES women. Low SES women include teenagers, unmarried women and nonwhite women, and high SES women are all others. For each regerssion, results are weighted by the number of births to mothers in the sample. The (weighted) fetal death ratio means for all women, high SES women, and low SES women are respectively 0.0148 (se = 0.0207), 0.0137 (0.0194), and 0.0112 (0.0222).

Appendix Table A7: Rainfall on April 22, 1970, and Individual Contributions to the LCV

	Total Contributions
Rain on Earth Day	-0.0750
(county cluster SEs)	(3.040)
(state cluster SEs)	(3.354)
Rain on Earth Day (levels)	-2.009
(county cluster SEs)	(1.359)
(state cluster SEs)	(1.475)
Rain on Earth Day (Extra Controls)	-2.524
(county cluster SEs)	(1.343)
(state cluster SEs)	(1.548)
Winsorized Rainfall	-3.15
(county cluster SEs)	(1.861)
(state cluster SEs)	(2.126)

Each coefficient is from a separate regression. Heteroskedasticity-robust standard errors, clustered by county and state, are reported in parentheses. The dependent variable is the total individual donations to the League of Conservation Voters in a county in a year; the years covered include 1978 to 1988. There are 27,654 observations in the sample. All regressions are weighted by the population.