Climatic Change (2020) 163:1007–1023
https://doi.org/10.1007/s10584-020-02923-y

Eco-reproductive concerns in the age of climate change

Matthew Schneider-Mayerson[1] · Kit Ling Leong[1]

Received: 20 August 2019 / Accepted: 29 October 2020 / Published online: 17 November 2020

Abstract
Media reports and public polls suggest that young people in many countries are increasingly factoring climate change into their reproductive choices, but empirical evidence about this phenomenon is lacking. This article reviews the scholarship on this subject and discusses the results of the first empirical study focused on it, a quantitative and qualitative survey of 607 US-Americans between the ages of 27 and 45. While 59.8% of respondents reported being "very" or "extremely concerned" about the carbon footprint of procreation, 96.5% of respondents were "very" or "extremely concerned" about the well-being of their existing, expected, or hypothetical children in a climate-changed world. This was largely due to an overwhelmingly negative expectation of the future with climate change. Younger respondents were more concerned about the climate impacts their children would experience than older respondents, and there was no statistically significant difference between the eco-reproductive concerns of male and female respondents. These and other results are situated within scholarship about growing climate concern in the USA, the concept of the carbon footprint, the carbon footprint of procreation, individual actions in response to climate change, temporal perceptions of climate change, and expectations about the future in the USA. Potential implications for future research in environmental psychology, environmental sociology, the sociology of reproduction, demography, and climate mitigation are discussed.

Keywords Climate change · Climate concern · Carbon footprint · Reproduction · Fertility · Mitigation

1 Introduction

In many countries, young people seem to be increasingly connecting climate change to their reproductive choices. This is suggested by the number of news and opinion articles covering

✉ Matthew Schneider-Mayerson
schneider–mayerson@yale–nus.edu.sg

[1] Yale-NUS College, College Ave West, Singapore

this phenomenon (e.g., Bielski 2019; Irfan 2019; Snow 2019) as well as the number of activists, public thinkers, and celebrities that are publicly discussing what was previously a private question. As US Representative Alexandria Ocasio-Cortez asked in March 2019, "Is it ok to still have children" in the age of climate change ("Ocasio-Cortez" 2019)? In response to this public questioning of reproductive intentions and practices in the context of climate change, the media and environmental organizations have conducted a handful of public polls (Miller 2018; Australian Conservation Foundation 2019; Morning Consult 2020), though they have often been interpreted and reported inaccurately.[1]

Empirical data about this phenomenon is needed given its potential significance to the experiences of large numbers of young people today, as well as the potential implications for environmental psychology, the sociology of climate change, the sociology of reproduction, environmental ethics, demography, and climate mitigation. This article discusses the results of the first empirical research focused on young people that are factoring climate change into their reproductive choices. It offers insight into the concerns, considerations, and expectations that are influencing these reproductive plans and choices. It concludes by discussing some of the implications of this phenomenon and identifying questions for future research.

2 Background and literature review

How many people are factoring climate change into their reproductive choices? A public poll conducted in the USA in 2018 found that among 20 to 45 year olds who did not have children and either did not want them or were not sure, 11% cited "worried about climate change" as one of their concerns (Miller 2018). More recently, a 2020 poll found that among 18 to 44 year old Americans without children, 14.3% cited climate change as a "major reason" for not having children at the time of the poll, while 20.7% cited it as a "minor reason" (Morning Consult 2020). This suggests that approximately 12.5 million Americans of what is traditionally considered childbearing age were not having children at least partially because of their climate concerns.[2] This number does not include the millions of American parents that are having fewer children than they desired because of climate change—the 2018 poll also found that 33% of all respondents who "had or expected to have fewer children than they considered ideal" cited "worried about climate change" as one of the motivating factors (Miller 2018). A different 2018 poll found a similar level of concern among environmentally engaged Australians (Australian Conservation Foundation 2019), suggesting that this eco-reproductive hesitation may be common in countries that are socioeconomically and culturally similar to the USA, such as many OECD nations.

To date, most of the academic research on the subject of reproductive choices in the age of climate change has been in the field of applied ethics, such as Rieder's *Toward a Small Family Ethic: How Overpopulation and Climate Change Are Affecting the Morality of Procreation*

[1] For example, the article publicizing the results of a 2018 BusinessInsider poll (Relman and Hickey 2018) claimed that the poll provided information about the number of Americans who are factoring climate change into their reproductive choices. In reality, it suggested a modest generational shift in applied ethics on the subject.

[2] Calculated using data from the US Census Bureau 2018, US Census Bureau 2019, Monte and Knop 2019, and Morning Consult 2020. This calculation assumes that of the approximately 50 million Americans between the ages of 20 and 45 who did not have children in 2019, the Morning Consult 2020 figures about the percentage of Americans of childbearing age who did not have children at least partially because of climate change concerns were representative of the entire US population.

(2016) and Conly's *One Child: Do We Have a Right to More?* (2016). Very little empirical scholarship has been published on the relationship between concerns about climate change and individual fertility intentions and choices. Within sociology, demography, and women's and gender studies there is a robust literature on how individuals decide whether to have children (e.g., Morgan and King 2001; Carmichael and Whittaker 2007; Blackstone and Stewart 2012; Testa et al. 2014), and on voluntary childlessness in the United States (e.g., Blackstone 2019) and elsewhere. At times, this literature touches on environmental issues. For example, within the literature on the decision not to parent, concerns about "population growth" were common in the 1970s and 1980s (Houseknecht 1987), and recent scholarship contains occasional references to concerns about "overpopulation" (e.g., Park 2005, pp. 394–5; Langdridge et al. 2007, p. 128), though these have not been the focus of sustained research or analysis. Additionally, there has been research on the relationship between general environmental concern and fertility intentions (Arnocky et al. 2012), suggesting a positive relationship between environmental concern and antireproductive attitudes. However, an analysis of the 2011 Eurobarometer survey found a positive relationship between climate concern and the intended number of children (De Rose and Testa 2015). And some scholars have begun to speculate on the potential link between climate change and fertility in developing countries (e.g., Thiede 2019).

The connection between fertility and socioecological concerns is a sensitive topic with a controversial and sometimes violent history (e.g., Robertson 2012) that continues today (e.g., Darby 2019). In recent years, there has been principled resistance, among both scholars (e.g., Murphy 2017) and public thinkers (e.g., Roberts 2017) to discussing the connection between fertility, population, and climate change, for a variety of reasons (Coole 2013). However, other scholars have highlighted the importance of acknowledging that population is an important factor in greenhouse gas emissions, and might therefore play a role in climate mitigation as well as adaptation (e.g., Haraway 2016; Bongaarts and O'Neill 2018). Historically, population and the production of greenhouse gases have been found to be nearly proportional (O'Neill et al. 2012), and scholars have argued that three-fourths of the global increase in emissions between 1990 and 2017 can be attributed to population growth, with one-fourth due to an increase in emissions per capita (Gerlagh et al. 2018). Some models predict that slower population growth would lead to a decrease in total emissions by 40% or more by the year 2100 (O'Neill et al. 2012). While much of the research on the connection between fertility, population, and climate change has focused on policy implications, such as increasing access to family planning and education for girls (e.g., Hawken 2017), this study demonstrates that some environmentally concerned individuals are factoring this connection into their own reproductive plans and choices. Especially given the number of people that seem to be thinking about their reproductive choices in relation to climate change, scholars need to be able to discuss this subject without conflating individual choices with policies that would sanction coercion or violence.

Despite growing bodies of research in adjacent areas of study, there is an absence of scholarship on the relationship between climate change and individual reproductive intentions and practices. This article fills an important gap in the scholarship and lays the groundwork for further research.

2.1 Research design and methodology

The primary research questions that informed the research design were the following: How are young people who are factoring climate change into their reproductive choices making these

decisions? Which factors are more important to them, and which are less important? How are they imagining a climate-changed future, and how are these expectations informing their reproductive choices?

Since there has been no empirical research published on the way that young climate-concerned people are thinking about their reproductive choices in relation to climate change, the research design was an exploratory survey. We expected that a detailed survey with branching and open-ended questions would result in the kind of rich data that is available through in-person interviews, but might be less subject to social desirability bias when it comes to emotionally and politically sensitive subjects such as reproductive choices. The survey contained 16 open-ended questions and between 24 and 31 multiple-choice questions, depending on the responses. The open-ended questions focused on respondents' emotions in relation to climate change; their personal and political actions in response to climate change; their anxieties, fears, and hopes about having children in the age of climate change; the conversations they have with others about this subject; and their vision of and concerns about the future. The multiple-choice questions were standard demographic questions and questions about how respondents feel about climate change, which actions they prioritize, and which actions they take. The survey questions were designed in consultation with the organization Conceivable Future, which has been organizing dialogs with Americans who are concerned about their reproductive choices in relation to climate change for the last half-decade. The survey questions are available in the electronic supplemental material. This article is focused on the responses to questions about respondents' concerns about the carbon footprint of having children; their concerns about the well-being of their existing, expected, or hypothetical children in a climate-changed future; and their visions or expectations of a future with climate change.

Snowball sampling was used to locate and recruit subjects that were otherwise difficult to locate (Atkinson and Flint 2001). Ten well-known climate thinkers, activists, and organizations posted the link to the anonymous survey on public Facebook and Twitter pages, which ensured that the survey would be disseminated widely.[3] The posting specified that respondents had to be 27 or older and had to be "connecting climate change to their reproductive choices." These inclusion criteria were included in the survey's screening questions, along with the Yale Program on Climate Change Communication's SASSY tool, which screened respondents for belonging in the "Alarmed" segment of Global Warming's Six Americas (Chryst et al. 2018). In consultation with Conceivable Future, 27 was selected as the minimum age to ensure that participants were not just registering fleeting anxieties, on the assumption that many Americans today do not begin thinking concretely about having children until their middle or late-twenties. At the end of the survey, respondents were asked to share the survey link with anyone who might qualify. For each respondent who completed the survey, US$20 was donated to one of ten environmental or reproductive justice organizations, from which the respondents were asked to choose at the survey's conclusion. We should expect that this altruistic compensation might lead to self-selection for altruistic individuals, and individuals who are concerned about climate change or reproductive justice.

Because of the significant media attention within the USA on Americans that are factoring climate change into their reproductive plans and choices, we focused our attention on US-

[3] While digital surveys risk a bias toward those who have Internet access and, given this methodology, those who use social media, the youthfulness of the target population of this survey mitigates that risk. Approximately 98.5% of Americans between 18 and 49 have Internet access, and approximately 83% of those aged 18 to 49 use social media. See Smith and Anderson 2018; Anderson et al. 2019.

Americans. A total of 1159 respondents passed the prescreen, including 845 Americans. Six hundred fifty-six of these Americans fell within the age range of 27–45. The upper limit of 45 was selected because it has conventionally been understood as the end of "childbearing age" in the USA, and because responses by participants in their fifties and sixties often demonstrated that they were retroactively "connecting" climate change to their past reproductive choices, but had not factored climate change into those choices at the time they were made. Data cleaning involved the removal of 30 responses that were retroactively connecting climate change to previous reproductive choices and 19 that had a completion rate below 90%. Given the dearth of scholarship on this subject, this research was built on a grounded theory approach to inductively generate conceptual frameworks and hypotheses (Glaser and Strauss 2017). The open-ended questions in the survey were not informed by existing conceptual frameworks and theories and therefore designed to be exploratory. For the qualitative survey responses discussed in this article, the researchers developed categories and subcategories based on thematic analysis, and independently coded the responses (Charmaz 2006). Representative examples have been selected to illustrate common themes.

There are benefits and limitations to this methodology. Virtual sampling and online surveys can be useful in accessing "hard to reach" populations; allow respondents to answer at a convenient time; can expand the size, scope, and geographical distribution of a sample; and can facilitate timely data analysis (Evans and Mathur 2005; Baltar and Brunet 2012). The primary limitation of this methodology is that the sample is not randomly selected, and that snowball sampling and recruitment through social media can lead to a homogenous sample. Indeed, the sample is relatively homogenous in terms of race and ethnicity, political identification, and educational attainment. The 607 respondents in this sample were predominantly white (88% white; 6% Asian; 3% Latinx; 2% Native American; < 1% Black; < 1% Middle Eastern), liberal (70% very liberal; 21% liberal; 4% moderate; < 1% conservative; 5% no opinion), and female (73% female; 22% male; 5% nonbinary). The majority (52%) had a graduate or professional degree, with another 41% having a bachelor's degree; 1% had an associate's degree; 4% had some college credit; 1% had a high school diploma or GED; and < 1% had received education up until 9th grade. 27% of respondents were located in the Northeast; 18% in the Midwest; 12% in the South; 41% in the West; and 2% were US citizens living abroad. 66% of respondents identified as heterosexual; 17% as bisexual; 4% as homosexual; 9% as "other"; and 3% preferred not to say. 24% of respondents were parents; 12% were nonparents who were planning to have children in the future; 29% were nonparents who were undecided on whether they would have children in the future; and 35% were nonparents who were committed to not having children.

Due to the sampling methodology and the sample's homogeneity in terms of race and ethnicity and educational attainment, the results obtained might not be representative of all Americans who are factoring climate change into their reproductive choices, or of people outside of the USA. However, the focus on a group of predominantly white Americans makes this research particularly relevant to the study of climate mitigation, since we should expect the reproductive choices of this population to have a greater impact on climate mitigation than other groups. This is due to the consistently high per capita greenhouse gas emissions in North America (e.g., Piketty and Chancel 2015) as well as the persistent racial wealth gap in the USA (e.g., Sullivan et al. 2015), which, combined with the concentration of greenhouse gas emissions among the wealthy (e.g., Gore 2015), makes the reproductive choices of white Americans likely to have a significant impact on future climate change.

3 Results

3.1 Concerns about the carbon footprint of procreation

Almost all survey respondents were concerned about the carbon footprint of procreation. Respondents were asked, "How concerned were/are you about your (potential) child's lifetime carbon footprint?"[4] with a rating scale that ran from 1, "Not at all concerned," to 5, "Extremely concerned." The mean was 3.71 out of 5 (Table 1), with 59.8% of respondents reporting being "very" or "extremely concerned" about the carbon footprint of procreation (Fig. 1).

Undecided respondents were more concerned about the carbon footprint of procreation than those who were planning to have children, who were more concerned than parents. Four tests were conducted to determine if the level of concern about the carbon footprint of procreation was statistically different between parents ($n = 144$), planning ($n = 73$), and undecided ($n = 178$) respondents. Statistical significance ($\alpha = 0.05$) was found via a Kruskal–Wallis equality-of-populations rank test ($\chi^2(2) = 6.247$, $p = 0.044$); but not found via a one-way ANOVA ($F(2, 395) = 2.84$, $p = 0.060$); Levene test ($F(2, 395) = 0.369$, $p = 0.691$); and Brown-Forsythe test ($F(2, 395) = 0.353$, $p = 0.703$). Following the Kruskal–Wallis test, pairwise comparisons from a post hoc Dunn test specified that between the three groups, significant differences were found between those undecided about having children and parents ($p = 0.007$) only, demonstrating that undecided respondents were significantly more concerned about the carbon footprint of procreation than parents.

An ordered logistic regression found no statistically significant association between age and an individual's odds of being concerned about the carbon footprint of procreation (odds ratio of − 0.027 (95% CI, −0.065 to 0.012), $z = -1.31$, $p = 0.190$). Additionally, no statistical significance was found in concern between males and females at the 5% level ($\alpha = 0.05$) via a Mann–Whitney U test (z-statistic = 1.701, $p = 0.089$). A Kruskal–Wallis found no significant difference in how respondents with at least a bachelor's degree answered the question, compared to those without ($\chi^2(2) = 0.087$, $p = 0.768$). Similarly, no significant difference was found in how respondents with a doctorate degree answered the question, compared to those without ($\chi^2(2) = 0.003$, $p = 0.957$).

In their responses to an open-ended follow-up question, many respondents described being conflicted in their concern about the carbon footprint of procreation. On one hand, most reported hearing about or reading summaries of academic papers about the carbon footprint of procreation and found this information compelling enough to factor it into what many people consider to be their most consequential life decision. As a childfree 32-year old consultant in Ohio wrote, "I cannot produce another person that will continue to destroy the planet, as they will inherit my first world lifestyle. I also cannot live with the feeling of responsibility that I made a decision to have a child for my own pleasure while destroying exactly what I'm fighting to save."[5] Many parents and respondents who were planning to have children noted that their concerns about the carbon footprint of procreation had led them to have, or plan to

[4] The survey utilized branching to present appropriately-worded questions to each respondent, but they are condensed here to apply to respondents in the categories parents, planning, and undecided. Respondents committed to being childfree were not presented with these quantitative questions. This was because their responses to this question would have been less reliable, since most of them had made the decision not to have children at some point in the past. As a result, they would either be reporting on something that had happened in the past, instead of describing their level of concern at the time of the survey, or reporting on a hypothetical concern in the present (how concerned they would be about their children's futures if they had children).

[5] Childfree, white, female, 42, abroad (Lebanon). All quotations are typical examples of the positions expressed by a number of survey respondents.

Table 1 Average concern about the carbon footprint of procreation and the climate impacts that children will experience for all responses, parents, planning, and undecided, female, and male. Standard deviation reported in parentheses

	All responses ($N = 395$)	Parents ($N = 144$)	Planning ($N = 73$)	Undecided ($N = 178$)	Female ($N = 305$)	Male ($N = 80$)
Concern about the carbon footprint of procreation	3.71 (1.10)	3.55 (1.12)	3.70 (1.04)	3.85 (1.10)	3.80 (1.01)	3.49 (1.29)
Concern about the climate impacts that children will experience	4.76 (0.52)	4.65 (0.58)	4.79 (0.44)	4.84 (0.49)	4.77 (0.51)	4.76 (0.53)

have, a smaller family. For example, a 38-year old teacher and mother in Minnesota said, "I really didn't think a lot about the carbon footprint of having another child, until I read something saying that the best thing you can do to reduce your carbon footprint is not reproduce. Thinking about that has influenced my decision not to have a third child."[6]

On the other hand, many respondents argued that viewing climate change through the lens of individual choice was a problematic, "neoliberal," and ineffective framing of a collective problem.[7] As a pregnant 36-year old doctoral candidate in New York put it, "I feel frustrated with the idea that I should not have children because of their lifetime carbon footprint. That puts an emphasis on individual sacrifice and responsibility that is not reflective of the actual causes (and possible solutions) for the problems we face with the climate—these are large-scale, systemic problems."[8] Similarly, a 37-year old civil engineer and father in Massachusetts wrote, "I'm not going to not have a family because economic and political leaders have fucked this up for everyone. That's not on me as an individual and it makes me mad that under our neoliberal/individualistic framing it's my responsibility to deny my spouse and myself that right. No, fuck that."[9]

Many respondents voiced both perspectives, and described struggling as they decided which one to prioritize. Many also went out of their way to clarify that while they were concerned about the carbon footprint of reproduction, they did not believe that "overpopulation" was a problem, and were not supporters of any kind of population control. For example, an undecided 28-year-old policy expert in Massachusetts wrote, "It's sort of a faux pas in the climate movement right now to talk about overpopulation because 'overpopulation' has frequently been used in the past to shame incredibly poor countries about their birth rates, and efforts at population control often have genocidal undertones (or just tones). The real problem is overconsumption." But, he continued, "Of course total consumption is closely tied to population." He reported being "extremely concerned" about the carbon footprint of procreation, commenting that for him, "adding another American to the mix is not a morally neutral act."[10]

3.2 Concerns about the climate impacts that children will experience

Concern about the carbon footprint of procreation was dwarfed by respondents' concern for the well-being of their existing, expected, or hypothetical children in a climate-changed future.

[6] Parent, white, female, 38, Minnesota.
[7] Undecided, Asian-American, female, 36, Illinois.
[8] Parent, white, female, 36, New York.
[9] Parent, white, male, 37, Massachusetts.
[10] Undecided, white, male, 28, Massachusetts.

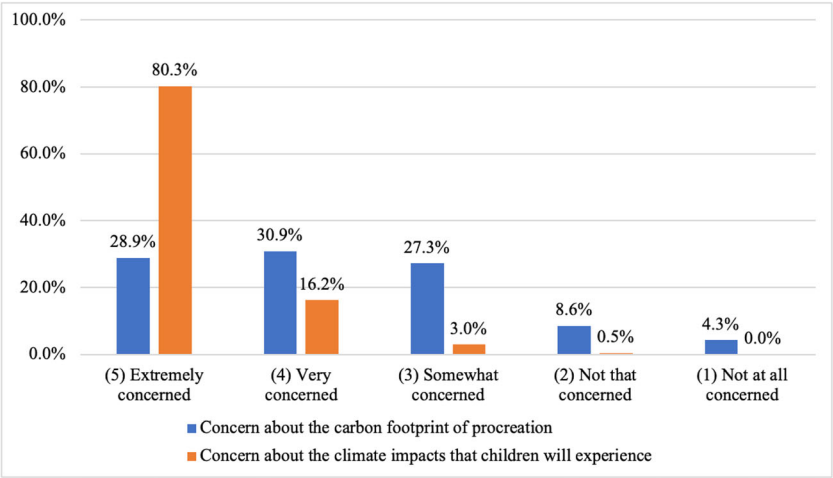

Fig. 1 Percentage breakdown of respondents' answers to "How concerned were/are you about your (potential) child's lifetime carbon footprint?" and "How concerned were/are you about the climate impacts your (potential) child would/will witness or experience?"

Respondents were asked, "How concerned were/are you about the climate impacts your (potential) child would/will witness or experience?" with the same rating scale, from 1, "Not at all concerned," to 5, "Extremely concerned." The mean was 4.76 out of 5, with 96.5% of respondents reporting being "extremely concerned" or "very concerned" with the climate impacts that their existing, expected, or hypothetical children will or would experience (Fig. 1).

Undecided respondents were more concerned about the climate impacts their children would experience than those who were planning to have children, who were more concerned than parents. Four tests were conducted to determine if the level of concern about the impacts their children would experience was different between parents ($n = 144$), planning ($n = 73$), and undecided ($n = 178$) respondents. Statistical significance ($\alpha = 0.05$) was found via a one-way ANOVA ($F(2, 395) = 5.230$, $p = 0.001$); Kruskal–Wallis equality-of-populations rank test ($\chi^2(2) = 15.242$, $p = 0.001$); Levene test ($F(2, 395) = 13.466$, $p = 0.001$); and Brown-Forsythe test ($F(2, 395) = 5.232$, $p = 0.006$). Following the Kruskal-Wallis test, pairwise comparisons from a post hoc Dunn test specified that between the three groups, significant differences were found between parents and those planning to have children ($p = 0.029$), and between those undecided about having children and parents ($p = 0.000$). As such, it can be concluded that parents were significantly less concerned about the climate impacts their children will experience compared to respondents who were undecided and planning to have children.

Younger respondents were more concerned about the climate impacts their children would experience than older respondents. An ordered logistic regression found that an increase in age was significantly negatively associated at the 5% level ($\alpha = 0.05$) with an increase in the odds of being concerned about (potential) impacts, with an odds ratio of −0.076 ($z = -2.84$ (95% CI, −0.128 to −0.023), $p = 0.005$). The difference between the responses of male and female respondents was not significant—no statistical significance was found at the 5% level ($\alpha = 0.05$) via a Mann–Whitney U test (z-statistic = −0.105, $p = 0.916$). A Kruskal–Wallis found no significant difference in how respondents with at least a bachelor's degree answered the question, compared to those without ($\chi^2(2) = 0.015$, $p = 0.902$). Similarly, no significant difference was found in how respondents with a doctorate degree answered the question, compared to those without ($\chi^2(2) = 0.025$, $p = 0.875$).

Whereas the qualitative comments about the carbon footprint of procreation tended to be abstract, the qualitative comments on this subject demonstrated a deep concern, anxiety, and even anguish about the climate impacts that participants expected their existing, expected, or hypothetical children to experience in the course of their lifetimes. A childfree 31-year-old writer in Washington wrote that "climate change is the sole factor for me in deciding not to have biological children. I don't want to birth children into a dying world. I dearly want to be a mother, but climate change is accelerating so quickly, and creating such horror already, that bringing a child into this mess is something I can't do."[11] An undecided 27-year-old project manager in Michigan voiced a similar ethical concern, writing, "I feel like I can't in good conscience bring a child into this world and force them to try and survive what may be apocalyptic conditions."[12] And a 38-year-old editor and mother in Florida described a common story: "I was first committed not to bring any children into this doomed world, but then I met my husband and fell in love and I wanted them. They have brought me so much joy, but I feel so guilty about it. I don't want them to have to suffer through the future humans have created for them. I worry about them being caught up in natural disasters (we live in Florida, so hurricanes have been a concern). I worry about them dealing with the massive unrest that will result from loss of natural resources and climate migration."[13]

Parental anxiety about how their children will fare in a climate-changed future was so strong that 6.3% of parents confessed to feeling some regret about having children due a sense of hopelessness and despair about climate change.[14] For example, a 40-year-old teacher and mother in Minnesota wrote, "I regret having my kids because I am terrified that they will be facing the end of the world due to climate change."[15]

3.3 Relationship between both concerns

According to their responses to these quantitative questions, 61.5% of respondents were more concerned about climate impacts their existing, expected, or hypothetical children will or would experience than the carbon footprint of procreation; 37.7% of respondents were equally concerned; and only 0.8% were more concerned about the carbon footprint of procreation. A Spearman's rank test yielded a significant positive association (test statistic: $r_s = 0.25$, $p = 0.000$). Similarly, a bivariate regression yielded a significant positive relationship with a slope of 0.50 (regression coefficient: $\beta = 0.503$, t statistic = 4.87, $p = 0.000$). Both tests show that respondents were significantly more concerned about the climate impacts their children would experience than the carbon footprint of procreation.

3.4 Visions of the future

As the qualitative responses demonstrate, respondents' concerns about the climate impacts their existing, expected, or hypothetical children will or would experience in the future depended upon their visions of and expectations about the future. To investigate how young US-Americans who are factoring climate change into their reproductive choices are thinking

[11] Childfree, white, female, 31, Washington.
[12] Undecided, white, female, 27, Michigan.
[13] Parent, white, female, 38, Florida.
[14] These regrets were expressed across a range of responses to open-ended questions in the survey. The intercoder rating for regret was high ($\alpha = 1.0$)
[15] Parent, white, female, 40, Minnesota.

about the future, the survey contained an open-ended question about the future, "What do you think the world will be like in 2050?" 2050 was selected as a midpoint between the near future and the distant future, and because it is frequently used as a reference point in projections of climate impacts. Ninety-eight respondents did not answer this question, or wrote some version of "I'm not sure or maybe I don't want to think about it," and 11 responses were uncategorizable.[16] The remaining 498 responses were independently coded by two researchers into five emergent categories—positive, mixed/neutral, negative, conditional, and hopeful—with a high intercoder reliability rating ($\alpha = 0.97$).

Of the 400 responses that offered a likely vision of the future (either positive, mixed/neutral, or negative), 92.3% were negative, 5.6% were mixed/neutral, and 0.6% were positive. The negative category contained negative descriptions of the future with no positive aspects. For example, a childfree 42-year-old researcher in Vermont wrote that the world in 2050 will be "a hot house hell, with wars over limited resources, collapsing civilization, failing agriculture, rising seas, melting glaciers, starvation, droughts, floods, mudslides, and widespread devastation."[17] Similarly, an undecided 27-year old model in Pennsylvania wrote, "Unrecognizable. Extreme weather. Food shortages. Political and economic dissolution. Large scale conflicts. Migration. Drought."[18] Responses in the mixed/neutral category contained a description of the future containing both positive and negative elements, or a neutral description of the future. For example, an undecided 31-year-old campaigner in California wrote, "Higher sea levels, high frequency of climate-related extreme weather events, Pacific Island nations underwater, lots of climate refugees, possible collapse of global capitalism (or on its way to collapse), more authoritarian regimes. But also a resistance that is community-based, caring for one another, and we have finally stopped using fossil fuels and instead rely on renewable energy."[19] Responses in the positive category contained more positive than negative aspects. For example, a 42-year-old nurse in Washington, wrote, "I'm cautiously optimistic that the millennials who get on my nerves often will indeed become awesome leaders in time, and so too the generations after them."[20]

Of the 498 total responses, 9.8% of responses were in the hopeful category, and 9.8% were in the conditional category. Hopeful responses contained a description of what respondents hoped to see in the future, as opposed to what they think is likely. For example, a childfree 29-year-old energy consultant in California wrote, "Hopefully more equitable than it is now, but I think natural disasters will become even more common and climate change will make things crazier. I think the world will be more divided along certain lines politically but I hope we are able to reach resolution on some ongoing conflicts of the 20th century and early 21st."[21] Responses in the conditional category described different possible futures, dependent on the actions taken in the present and near future. For example, a 44-year-old conservation worker and mother in California wrote, "If we don't adequately address climate change: Less predictable, more civil unrest, wars over finite resources, water for example, more refugees, pain, crime suffering, disease, famine, inequality. More frequent natural disasters, displaced populations, fully abandon [sic] cities, endangered/extinct wildlife. If we do address it

[16] Childfree, Asian-American, female, 43, California.
[17] Parent, white, male, 42, Vermont.
[18] Undecided, white, gender fluid, 27, Pennsylvania.
[19] Undecided, white, female, 31, California.
[20] Childfree, white, female, 42, Washington.
[21] Childfree, white, female, 29, California.

appropriately the most progressive society we have seen. A bright future full of potential and promise."[22] For more examples from each category, see the electronic supplemental material.

As these examples suggest, the negative visions of the future tended to be intensely negative. A composite narrative (Willis 2018) of common aspects of responses in the Negative category, included in the electronic supplemental material, describes a future of overlapping and reinforcing climatic, ecological, epidemiological, social, economic, political, geopolitical, and migration crises. Respondents expected the psychological toll of these developments to be significant, and this seemed to constitute a central element of respondents' concerns about having children in the context of climate change. As a 30-year-old software engineer in California wrote, "I strongly believe that children alive today are going to live through a long period of trauma, violence and devastation on a global scale that will rival World War I in its sheer terror unleashed on an unprepared population." In this context, he, along with many other respondents, was "uncomfortable bringing children into the world given the circumstances."[23]

3.5 Reproductive considerations beyond climate change

While all the respondents in this sample reported factoring climate change into their reproductive plans and choices, it is worth noting that climate change was rarely discussed as the only consideration. In response to an open-ended question posed to childfree respondents—"What factors were involved in your decision not to have biological children?"—respondents also referenced more traditional factors, such as problems finding a suitable partner; their partner's preferences; financial concerns; reproductive capabilities; physical and mental health; the lack of a strong desire to have children; as well as troubling global issues beyond anthropogenic climate change (such as the perception of growing inequality and injustice and the perception of rising fascism in the US and around the world). When the qualitative responses by parents, planning, and undecided respondents (to various open-ended survey questions) touched on reproductive considerations beyond climate change, these factors were also present.

Additionally, the extent to which climate change was described as being factored into respondents' reproductive plans and choices varied widely. Some respondents stated unambiguously that climate change was the sole reason for choosing not to have children, like the 32-year-old investor in Oregon who wrote, "I want a family. I want biological children. But I won't have them" because of the "devastating effects of climate change."[24] For others, climate change was the primary but not the sole reason for choosing not to have children or to have fewer children than they desired, such as the tech worker in Minnesota who reported that "climate change is the #1 with a bullet reason I'm not having kids."[25] For others, such as a 36-year-old self-employed woman in Northern California, "many, many factors have gone into this decision," one of which was climate change.[26]

[22] Parent, white, female, 44, California.
[23] Undecided, white, male, 30, California.
[24] Childfree, white, female, 32, Oregon.
[25] Childfree, white, female, 30, Minnesota. "With a bullet" is a colloquial expression meaning that something is quickly rising to the top.
[26] Childfree, white, female, 36, California.

4 Discussion

This research confirms that some climate-concerned young people are now factoring climate change into what many people consider to be the most intimate and consequential decision an adult makes in their life course—the decision about whether to conceive and raise children, and how many.[27] In this sample, concerns about the climate impacts that children will experience were stronger and more affectively charged than concerns about the carbon footprint of procreation.

Although respondents' concerns about the carbon footprint of reproduction were less intense and emotional than their concerns about the climate impacts their children will or would experience, it is striking that 87.1% of respondents who were parents, planning, or undecided were "extremely," "very," or "somewhat" concerned about the carbon footprint of reproduction. While the assertion of an individualized "carbon footprint" and its application to reproductive choices is in some ways a new form of a decades-old Malthusian concern about 'overpopulation' in environmental discourse (e.g., Robertson 2012), it is, in other ways, a new concept. As a metaphor and accounting metric, the carbon footprint was popularized between 2007 and 2011 (Turner 2014, pp. 59–60; Girvan 2017, pp. 32–36), and it carries some complicated ethical and political implications that ought to be closely examined given its sudden centrality to environmental discourse and ethics.[28] The concept of a "carbon legacy" of reproduction was developed in a journal article published in 2009 (Murtaugh and Schlax 2009), using data from 2005. Until recently, it was the only published study that calculated the carbon footprint of conceiving biological children. Its results have been accepted and presented, often in somewhat reductive ways, by scholars (e.g., Wynes and Nicholas 2017) as well as a large number of journalists, and these web articles have been shared widely. For example, a 2017 article in the British newspaper *The Guardian*, titled "Want to fight climate change? Have fewer children" (Carrington 2017), has been shared over 11,000 times, with evocative graphics optimized for social media.[29] A single study, now over a decade old, seems to have had a remarkable influence on the way that the respondents in this sample thought about their reproductive intentions and practices—and, most likely, millions of Americans along with them. While it is beyond the scope of this article to explore in detail the reductive and potentially misleading ways that Murtaugh and Schlax's careful study has been interpreted and presented by journalists and others, it is worth noting that a recent (nonpeer reviewed) study, examining the same question, came to a very different conclusion (Halstead and Ackva 2020). While there have been a number of single-exposure experiments on the influence of footprint information on behavioral intentions (e.g., Brook 2011; Toner et al. 2014), there has been little social scientific research on what happens when this novel concept becomes deeply embedded, over a period of years or even decades, in the normative ethical considerations of climate-alarmed people, who constitute a growing subset of the population (Goldberg et al.

[27] This article is concerned with reproductive choices in the age of climate change, but not all people have the freedom or ability to choose whether to have children, or how many. That denial is an incredibly important topic, but it is not the focus of this article. Additionally, this article is focused on the question of biological reproduction, but one alternative to conceiving biological children, frequently cited by respondents, is adoption. This space does not permit an appropriately detailed discussion of how adoption fits into these considerations, though it is worth noting that adoption in the United States is often a difficult, lengthy, and often expensive process, and therefore was carried out less frequently than it was praised by survey respondents.

[28] See, for example, Paterson and Stripple 2010; Turner 2014; Girvan 2017.

[29] Though this article reported on the results of the study by Wynes and Nicholas 2017, Wynes and Nicholas utilized data from Murtaugh and Schlax 2009.

2020). Given the dearth of research on the carbon footprint of reproduction and its apparent influence on the way that some climate-concerned people are thinking about their most intimate life choices, further research is needed.

This application of the normative ethics of the carbon footprint to individual reproductive intentions and choices occurs within the context of a vigorous and sometimes polarizing debate, among both scholars and environmentalists, about the value of emphasizing individual actions in response to climate change. Supporters of encouraging high-impact individual actions—which frequently include eating a plant-based diet, purchasing renewable energy, flying less, living car-free, and having a smaller family—argue that while individuals making ethical choices might have a small direct effect on overall greenhouse gas emissions, these choices have positive and potentially nonlinear spillover effects (e.g., Truelove et al. 2014). Others contend that individual ethical choices can lead to moral licensing, in which adoption of one moral behavior results in a decreased likelihood of the adoption of another (e.g., Tiefenbeck et al. 2013), which would be especially problematic if individual ethical choices lead to a decreased desire and willingness to engage politically (e.g., Mann and Brockopp 2019). The empirical evidence to date has been mixed (Maki et al. 2019). This research demonstrates that some young people are struggling with this question in their most significant life choices.

Unlike carbon footprint concerns, concerns about the climate impacts that children will or would experience were based on expectations, hopes, and fears about the future. Of course, climate change is both a present and a future concern; climate change is already happening, but climate concerns, fears, and anxieties are future-oriented, given the lag between greenhouse gas emissions and climatic change (e.g., Ricke and Caldeira 2014), along with the expected ecological, epidemiological, social, economic, and political consequences. Given that Americans are increasingly connecting extreme weather to climate change (Deeg et al. 2019), and that there is growing alarm about climate change (Goldberg et al. 2020), it is not surprising that some Americans (and people all around the world) who understand the lag between emissions and consequences are combining extrapolations from current and recent events with reports about negative projections to develop intensely negative visions and expectations of the future. This psychological effect of climate change—an anticipatory anxiety, or "pre-traumatic stress disorder" (Davenport 2017)—is only beginning to be widely acknowledged and studied (Gifford and Gifford 2016), and deserves more attention given the number of Americans that are now "alarmed" about climate change (Goldberg et al. 2020).

Social scientists have frequently seen the tendency to imagine climate change in the future as a problem to be overcome, with scholarship in environmental communication focused on the ways in which climate change might be made more psychologically proximate. While perceptions of climate futures tend to have less impact on actions in the present (e.g., Spence and Pidgeon 2010), reproductive choices and plans might constitute an exception to this general rule. This is because reproduction is inherently tied to futurity; prospective parents who are attempting to predict what the lives of their children might be like as adults are, by necessity, imagining the future. If perspectives on the future change over time, it would seem likely to have some effect (of indeterminate size) on reproductive intentions and choices. Indeed, it has been observed historically that when expectations about the future have become less positive, such as in Russia after the fall of the Soviet Union, fertility has seen a decline (Brainerd 2007).

How widely shared is the intensely negative and declensionist vision of the future expressed by the majority of participants in this sample? It is possible that these respondents

had an exceptionally negative perception of the future, since the sampling methodology might lead to self-selection for this very attribute. However, the fact that this particular sample had a negative perception of a climate-changed future is line with what we might expect from a recent public poll on expectations of the future, which found that Americans expect the average standard of living to be worse in 2050 than it is today; and that Democrats are more likely than Republicans to expect the environment to become worse off in the future (Pew Research Center 2019). While it is beyond the scope of this article to evaluate which aspects of this sample's composite vision of the world in 2050 (presented in the electronic supplemental material) are more or less probabilistically likely, or to discuss how respondents might have come to view the future in this way, it is notable that this composite vision bears striking similarities to recent popular American nonfiction books and articles that attempt to describe a climate-changed future, such as David Wallace-Wells' bestseller, *The Uninhabitable Earth* (Wallace-Wells 2019). It also bears similarities to widely read American novels of climate fiction, which are frequently set in apocalyptic climate futures (Schneider-Mayerson 2017). Further research might determine how widespread this expectation of an intensely negative future is in the USA (and elsewhere), whether it is concentrated among specific groups, and whether there is a reliable correlation between negative expectations about the future and reproductive plans and choices.

While all participants in this sample reported factoring climate change into their reproductive plans or choices, it was rarely described as the sole consideration. In this sample, as for most people of child-bearing age, decisions about reproduction were the product of a multitude of factors, including cultural and familial attitudes about the ideal family size; national and state laws and policies; employment opportunities; financial considerations; the desires of one's partner; and reproductive capabilities (e.g., Parker and Alexander 2004). Future research might attempt to determine which of these factors are most salient for different groups of people that are factoring climate change into their reproductive choices.

Given the sampling methodology utilized for this study, these results are not considered generalizable. In particular, this sample was composed predominantly of white Americans, which did not allow us to compare the concerns of different racial and ethnic groups. Further research might determine whether different racial and ethnic groups are more or less concerned about the carbon footprint of procreation and the climate impacts their children might experience.

Additionally, this study is limited by its reliance on self-reporting. While there is no way around this limitation when it comes to investigating the reasons why individuals make reproductive choices at the micro level, it means that there is some level of uncertainty with the results. It is possible, for example, that some respondents made individual reproductive choices for unrelated, "nonrational" (Overall 2012, 205), or unconscious reasons, and then explained those decisions post facto with reference to their climate concerns. Indeed, some survey respondents acknowledged this possibility in their responses. At the very least, we might consider these concerns to be part of an eco-reproductive vocabulary of motives (Mills 1940), by which individuals make sense of and explain their reproductive choices to themselves and to others by drawing on what they imagine to be socially and culturally acceptable explanations.

5 Conclusion

While widespread eco-reproductive concerns in relation to climate change seem to constitute a relatively recent phenomenon, these concerns seem unlikely to disappear. Besides the expected

longevity of climate change itself, we are in a period of growing climate concern (Goldberg et al. 2020), including more widespread concern among younger generations (Ballew et al. 2019), in which the effects of climate change are becoming more obvious and Americans are increasingly connecting extreme weather to climate change (Deeg et al. 2019). As such, it would not be surprising if the percentage of young people who are factoring climate change into their reproductive plans and choices grows over time.

This research has implications for multiple areas of study, including environmental ethics, environmental sociology, the sociology of reproduction, and demography. The fertility rate in the USA has been declining over the last decade, from 2.12 births per woman in 2007 to 1.73 in 2018, as it has in a number of other industrialized countries. This has contributed to alarming headlines about "the end of babies" (Sussman 2019). It is possible that growing climate concerns account for some percentage of the most recent decline in fertility, though further research is needed to understand whether this is the case. Further research is also needed to ascertain to what extent these eco-reproductive concerns are shared around the world.

Finally, this research may have implications for climate modelers. The phenomenon of climate concern contributing to a reluctance to have children raises the possibility that so many young people in wealthy, high-emissions nations will choose to have smaller families or forego procreation entirely that they may succeed in one of their goals: influencing the overall fertility rate, population, and production of greenhouse gases, and thus contributing, to some extent, to climate mitigation.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s10584-020-02923-y.

Acknowledgements The authors would like to acknowledge the generous assistance of Josephine Ferorelli, Cameron Leader-Picone, Dylan Leong, Michael Maniates, Marvin Joseph Montefrio, Valentina Zuin, and the anonymous referees.

References

Anderson M, Perrin A, Jiang J, and Kumar M (2019) 10% of Americans don't use the internet. Who are they? Pew Research Center, 7

Arnocky S, Dupuis D, Stroink ML (2012) Environmental concern and fertility intentions among Canadian university students. Popul Environ 34(2):279–292

Atkinson R, Flint J (2001) Accessing hidden and hard-to-reach populations: snowball research strategies. Soc Res Update 33(1):1–4

Australian Conservation Foundation (2019) What do women think about climate change? Australian Conservation Foundation and 1 Million Women, https://www.acf.org.au/women_will_change_their_lives_and_votes_for_climate_action. Accessed 11 Nov 2020

Ballew M, Marlon J, Rosenthal S, Gustafson A, Kotcher J, Maibach E, Leiserowitz A (2019) Do younger generations care more about global warming? Yale Program on Climate Change Communication

Baltar F, Brunet I (2012) Social research 2.0: virtual snowball sampling method using Facebook. Internet Res 22(1):57–74

Bielski Z (2019) 2019. The new 'childfree.' The Globe and Mail, October 9, 2019

Blackstone A (2019) Childfree by choice: the movement redefining family and creating a new age of Independence. Dutton

Blackstone A, Stewart MD (2012) Choosing to be childfree: research on the decision not to parent. Sociol Compass 6(9):718–727

Bongaarts J, O'Neill BC (2018) Global warming policy: is population left out in the cold? Science 361(6403): 650–652

Brainerd E (2007) The baby decision amid turmoil: understanding the fertility decline in Russia of the 1990s. National Council for Eurasian and East European Research
Brook A (2011) Ecological footprint feedback: motivating or discouraging? Soc Influ 6(2):113–128
Carmichael GA, Whittaker A (2007) Choice and circumstance: qualitative insights into contemporary childlessness in Australia. Eur J Population 23:111–143
Carrington D Want to fight climate change? Have fewer children. The Guardian, July 12, 2017. https://www.theguardian.com/environment/2017/jul/12/want-to-fight-climate-change-have-fewer-children. Accessed 11 Nov 2020
Charmaz K (2006) Constructing grounded theory: A practical guide through qualitative analysis. SAGE Publications, London
Chryst B, Marlon J, van der Linden S, Leiserowitz A, Maibach E, Roser-Renouf C (2018) Global warming's "Six Americas Short Survey": audience segmentation of climate change views using a four-question instrument. Environ Commun 12(8):1109–1122
Conly S (2016) One child: do we have a right to more? Oxford University Press
Coole D (2013) Too many bodies? The return and disavowal of the population question. Environ Polit 22(2): 195–215
Darby L (2019) What is eco-fascism, the ideology behind attacks in El Paso and Christchurch? GQ, August 7, 2019
Davenport L (2017) Emotional resiliency in the era of climate change: a clinician's guide. Jessica Kingsley Publishers
De Rose A, and Testa MR (2015) Climate change and reproductive intentions in Europe. In Italy in a European Context: Research in Business, Economics, and the Environment, Donatella Strangio and Giuseppe Sancetta (eds), 194–212. Palgrave Macmillan UK
Deeg K, Lyon E, Leiserowitz A, Maibach E, & Marlon J (2019) Who is changing their mind about global warming and why? Yale Program on Climate Change Communication
Evans JR, Mathur A (2005) The value of online surveys. Internet Res 15(2):195–219
Gerlagh R, Lupi V and Galeotti M (2018) Family planning and climate change. CESifo Working Paper, No. 7421
Gifford E, Gifford R (2016) The largely unacknowledged impact of climate change on mental health. Bull At Sci 72(5):292–297
Girvan A (2017) Carbon footprints as cultural-ecological metaphors. Routledge
Glaser BG, Strauss AL (2017) Discovery of grounded theory: strategies for qualitative research. Routledge, New York
Goldberg M, Gustafson A, Rosenthal S, Kotcher J, Maibach E, and Leiserowitz A (2020) For the first time, the alarmed are now the largest of global warming's six Americas. Yale Program on Climate Change Communication
Gore T (2015) Extreme carbon inequality: why the Paris climate deal must put the poorest, lowest emitting and most vulnerable people first. Oxfam
Halstead J, and Ackva J (2020) Climate and lifestyle report. Founders pledge, founderspledge.com/stories/climate-and-lifestyle-report. Accessed 11 Nov 2020
Haraway DJ (2016) Staying with the trouble: making kin in the Chthulucene. Duke University Press
Hawken P (2017) Drawdown: the Most comprehensive plan ever proposed to reverse global warming. Penguin Books
Houseknecht SK (1987) Voluntary childlessness. In handbook of marriage and the family, edited by Sussman, M.B., Steinmetz, S.K. and Peterson, G.W. Springer Science & Business Media
Irfan U (2019) We need to talk about the ethics of having children in a warming world. Vox, March 11, 2019
Langdridge D, Sheeran P, Connolly K (2007) Understanding the reasons for parenthood. J Reprod Infant Psychol 23(2):121–133
Maki A, Carrico AR, Raimi KT, Truelove HB, Araujo B, Yeung KL (2019) Meta-analysis of pro-environmental behaviour spillover. Nat Sustain 2(4):307–315
Mann Michael E, and Brockopp J (2019) You can't save the climate by going vegan. Corporate polluters must be held accountable USA Today, June 3, 2019
Miller CC (2018) Americans are having fewer babies. They told us why. The New York Times
Mills CW (1940) Situated actions and vocabularies of motive. Am Sociol Rev 5(6):904–913
Monte LM, Knop B (2019) Men's fertility and fatherhood: 2014. US Census Bureau Curr Popul Rep:70–162
Morgan SP, King RB (2001) Why have children in the 21st century? Biological predisposition, social coercion, rational choice. Eur J Population 17(1):3–20
Morning Consult (2020) National Tracking Poll #200926. https://assets.morningconsult.com/wp-uploads/2020/09/28065126/200926_crosstabs_MILLENIAL_FINANCE_Adults_v4_RG.pdf. Accessed 11 Nov 2020
Murphy M (2017) The economization of life. Duke University Press

Murtaugh PA, Schlax MG (2009) Reproduction and the carbon legacies of individuals. Glob Environ Chang 19(1):14–20
O'Neill BC, Liddle B, Jiang L, Smith KR, Pachauri S, Dalton M, Fuchs R (2012) Demographic change and carbon dioxide emissions. Lancet 380(9837):157–164
"Ocasio-Cortez Latest Rant" (2019) YouTube, February 25, 2019, https://www.youtube.com/watch?v=ZIoK5cJx6lw. Accessed 13 Aug 2019
Overall C (2012) Why have children? MIT Press, The Ethical Debate
Park K (2005) Choosing childlessness: Weber's typology of action and motives of the voluntarily childless. Sociol Inq 75(3):372–402
Parker R, Alexander M (2004) Factors influencing men's and women's decisions about having children. Fam Matters 69:24
Paterson M, Stripple J (2010) My Space: governing individuals' carbon emissions. Environ Plan D Soc Space 28(2):341–362
Pew Research Center (2019) "Looking to the future, public sees an America in decline on many fronts." March 20119. https://www.pewsocialtrends.org/2019/03/21/public-sees-an-america-in-decline-on-many-fronts/. Accessed 11 Nov 2020
Piketty T, and Chancel L (2015) "Carbon and inequality: from Kyoto to Paris." Trends in the global inequality of carbon emissions (1998–2013) and prospects for an equitable adaptation fund. Paris: Paris School of Economics
Relman E and Hickey W (2018) More than a third of millennials share rep. Alexandria Ocasio-Cortez's worry about having kids while the threat of climate change looms. BusinessInsider US
Ricke KL, Caldeira K (2014) Maximum warming occurs about one decade after a carbon dioxide emission. Environ Res Lett 9(12):124002
Rieder T (2016) Toward a small family ethic: how overpopulation and climate change are affecting the morality of procreation. Springerbriefs in Public Health
Roberts D (2017) I'm an environmental journalist, but I never write about overpopulation. Here's why. Vox
Robertson T (2012) The Malthusian moment: global population growth and the birth of American environmentalism. Rutgers University Press
Schneider-Mayerson M (2017) Climate change fiction. In: Smith RG (ed) American Literature in Transition: 2000–2010. Cambridge University press, pp 309–321
Smith A and Anderson M (2018) Social media use in 2018. Pew Research Center, 1
Snow D (2019) The big factor stopping thousands of women from starting a family. The Sydney Morning Herald February 11, 2019
Spence A, Pidgeon N (2010) Framing and communicating climate change: the effects of distance and outcome frame manipulations. Glob Environ Chang 20(4):656–667
Sullivan L, Meschede T, Dietrich L, and Shapiro T (2015) The racial wealth gap: why policy matters. Institue for assets and social policy, Brandeis University. DEMOS
Sussman AL (2019) The end of babies. The New York Times, November 16, 2019
Testa MR, Cavalli L, Rosina A (2014) The effect of couple disagreement about child-timing intentions: a parity-specific approach. Popul Dev Rev 40(1):31–53
Thiede B (2019) Climate change will likely influence fertility rates. New Security Beat, www.newsecuritybeat.org/2019/09/climate-change-influence-fertility-rates. Accessed 27 Feb 2020
Tiefenbeck V, Staake, Roth K, Sachs O (2013) For better or for worse? Empirical evidence of moral licensing in a behavioral energy conservation campaign. Energy Policy 57:160–171
Toner K, Gan M, Leary MR (2014) The impact of individual and group feedback on environmental intentions and self-beliefs. Environ Behav 46(1):24–45
Truelove HB, Carrico AR, Weber EU, Raimi KT, Vandenbergh MP (2014) Positive and negative spillover of pro-environmental behavior: an integrative review and theoretical framework. Glob Environ Chang 29:127–138
Turner JM (2014) Counting carbon: the politics of carbon footprints and climate governance from the individual to the global. Glob Environ Polit 14(1):59–78
US Census Bureau (2018) Annual estimates of the resident population by single year of age and sex for the United States: April 1, 2010 to July 1, 2017
US Census Bureau (2019) Fertility of women in the United States: 2018
Wallace-Wells D (2019) The uninhabitable earth: life after warming. Tim Duggan Books
Willis R (2018) The use of composite narratives to present interview findings. Qual Res 19(4):471–480
Wynes S, Nicholas KA (2017) The climate mitigation gap: education and government recommendations miss the most effective individual actions. Environ Res Lett 12(7):074024