




The role of perceptions and social norms in shaping women's fertility preferences: a case study from Ethiopia

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Abstract

The population–environment–food nexus is a sustainability challenge for the Global South, and for Africa in particular, where rapid human population growth typically overlaps with high levels of food insecurity and environmental degradation. In this context, it is important to understand the reasons driving high fertility in these regions. Here, we examined possible determinants of women's fertility preferences in rural southwestern Ethiopia. Using a survey tool ($n = 120$), we assessed women's perceptions of four key environmental stressors, namely food insecurity, environmental degradation, human population growth, and land scarcity. Through statistical modelling we tested whether there was a relationship between perceptions of future trends in these stressors and women's fertility preferences; expressed as their desired number of children and use of family planning methods. This analysis was complemented by a qualitative content analysis of the survey's open-ended questions, to contextualize and interpret the quantitative data. Our quantitative results indicated that perceptions of future trends in key stressors had little effect on fertility preferences of respondents, with the exception of perceptions of human population growth. Our qualitative data suggested that this may be due to the influence of social-cultural norms and religion, decision-making with the husband, as well as a perceived utilitarian value of children. These findings have important implications for the development of interventions to slow down human population growth. Our findings suggest the need to look beyond improved physical access to family planning, and develop a new suite of deliberative approaches that engage with social norms, religion, and gender equity.

Keywords Environmental degradation · Human population growth · Fertility · Food security

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Introduction

Human population growth is a key driver underlying environmental degradation and food insecurity (Crist et al. 2017). Especially, the indirect influence of human population growth on the degradation of natural resources, e.g. through deforestation, overexploitation or pollution, is well established (Marques et al. 2019; Díaz et al. 2019). Population growth also exacerbates food insecurity and poverty (Hall et al. 2017). The population–environment–food nexus is especially challenging in the Global South and in Africa in particular. Here, vulnerabilities to food insecurity are high (FAO 2019), environmental degradation rapidly increasing (Laurance et al. 2014), and fertility rates are the highest worldwide (Bongaarts 2017). Compared to Latin America & Caribbean and South Asia, the decline in fertility rates in Sub-Saharan Africa has been much slower (as of 2019, 2.0, 2.4, and 4.6 births per women, respectively) (World Bank 2019), despite general improvements in access to family planning services and increased contraception uptake (Sharan et al. 2011; Ahmed et al. 2019). To facilitate and contribute to the long-term sustainability on the African continent, it is, therefore, vital to better understand which factors drive high fertility, not only at a regional level but importantly, within the local context. Knowing the current key determinants of fertility preferences of women, in turn, would help to better target measures to slow down human population growth.

To date, research focusing on fertility determinants has been primarily focused on the role of demographic factors, education (Martin 1995; Bongaarts et al. 2017) and the social-cultural context (Caldwell and Caldwell 1987). In contrast, perceived environmental stressors—such as land scarcity or food insecurity—could also influence fertility but have received far less attention. Further, existing studies on potentially important environmental stressors have typically explored the relationships between a given stressor and fertility preferences in isolation (e.g. Ghimire and Mohai 2005; DiClemente et al. 2021) whereas studies that jointly examine different stressors and their influence on fertility preferences are missing (but see Rovin et al. 2013; Ezra 2001 for an approximated approach). Moreover, the majority of research that examines determinants of fertility preferences is derived from cross-sectional studies such as demographic health surveys, while detailed local accounts of how people perceive different environmental stressors are typically lacking.

These knowledge gaps—on the influence of multiple environmental stressors and locally contextualized fertility preferences—hamper the ability to fully understand, and subsequently counteract, the drivers behind current

patterns of rapid population growth, which is an issue of global importance (IPBES 2019). Understanding how individuals perceive the state of their environment and potential threats to their livelihoods, and understanding if and how these perceptions influence their reproductive preferences and their decision-making can help elicit some of the key drivers of high fertility. Such insights, in turn, are vital to design appropriate reproductive health programs and to inform population and sustainable development policies.

Here, we examined the determinants of women's fertility preferences in southwestern Ethiopia, including the influence of perceptions of different environmental stressors. We focused on perceptions because these represent the way in which people organize and interpret information (Bennett 2016). As such, perceptions have a key influence on decision-making processes and behavior (Pyhälä et al. 2016), and may be particularly important in contexts of subsistence livelihoods and resource constraints, where households are vulnerable to both food insecurity and environmental degradation. We considered four key environmental stressors, namely food (in)security, environmental degradation, human population growth, and land scarcity. Previous studies have found these stressors key issues for livelihoods in the case study (e.g. Manlosa et al. 2019a). We examined to what extent these stressors could explain women's fertility preferences, in terms of desired number of children and use of family planning methods. We had three specific objectives: (1) to explore women's perceptions regarding future trends in local environmental conditions, food security, human population growth, and land scarcity; (2) to examine women's fertility preferences in relation to their perceptions of environmental stressors; and (3) to consider the influence of social-cultural factors on fertility preferences. Before introducing the empirical part of our study, we provide an additional section of background on existing literature examining the determinants of fertility preferences and fertility behavior, including the role of perceptions of environmental stressors. This section serves as a theoretical foundation for our research and includes important contextual information on our focal study area.

Background and study area

Women's fertility preferences—including the desired number of children and the use of modern family planning—are influenced by and construed within a collection of social, economic, and cultural factors that operate at multiple scales with feedbacks that can balance or reinforce one another. Demographic factors (such as age and geographic context), educational attainment (Martin 1995; Bongaarts 2003;

Bongaarts et al. 2017), religion (Adsera 2006) and social norms and cultural beliefs (Caldwell and Caldwell 1987) are known to influence women's fertility preferences and the uptake of family planning methods, and consequently to influence fertility levels. For instance, in developing regions, urban women typically have considerably fewer children than rural women (Shapiro and Gebreselassie 2013). Also, increases in the educational attainment of young girls and women tend to increase the age of marriage and to delay the timing of the first child (Ikamari 2005; Smith et al. 2012). Education also promotes the uptake of family planning methods, ultimately contributing to a decrease in the desired family size (Bongaarts 2010; Dynes et al. 2012; Kebede et al. 2021). On the other hand, the influence of religion on fertility preferences and fertility behavior is mixed and interplays closely with social-economic context (Heaton 2011). Furthermore, fertility preferences are also formed within social-cultural contexts that include different norms, beliefs and expectations around fertility behavior. A norm is a prevailing behavioral pattern in a social group which is maintained through collectively held understandings of acceptable actions and through social interactions (Nyborg et al. 2016). For instance, in the context of contraceptive use, Dynes and colleagues (2012) found that in Kenya, community acceptance of contraceptive use was a strong determinant in the uptake of contraception by both men and women.

Throughout much of Africa, many households' livelihoods depend primarily on subsistence farming and on the collection of natural resources, such as firewood, fodder and water. These are time-consuming activities for the household unit (Kes and Swaminathan 2006), and thus children can have a utilitarian value as a source of labor (Robinson 1997; Admassie 2002). Especially when natural resources deteriorate or become scarce, the perceived need to increase family sizes may, therefore, rise (Dasgupta 1995; de Sherbinin et al. 2008; Brauner-Otto and Axinn 2017). On the other hand, in situations of resource scarcity, it may be more difficult to support a household with many children (Abernethy 1997; Biddlecom et al. 2005) and individuals might perceive a future in which their livelihoods are troubled by food insecurity. Such perceptions of resource scarcity could then contribute to a smaller desired number of children, out of concern of not having enough means to adequately provide for all family members. For instance, DiClemente and colleagues (2021) found that in Tanzania, women who experienced periods of hunger in the household were 19% less likely to desire more children when compared to women whose households did not face hunger periods. Another study in Burkina Faso, shows that for women living in the periphery of Ouagadougou, there were unfavorable periods in the year to bear children, due to the experienced seasonal food insecurity (Grace et al. 2017). Further, in Northern Ethiopia Ezra (2001) found that the demographic changes

observed between 1984 and 1994 (including declines in fertility and increased acceptance of contraception), were closely related with long periods of drought and persistent food insecurity. Likewise, in subsistence economies where access to land is a critical determinant of food security, land scarcity and high population density can represent an additional source of concern, and may motivate a preference for a smaller family size. Shreffler and Nii-Amoo Dodoo (2009) suggest that in rural Kenya the lack of land availability for farming together with inheritance norms and human population pressure influenced fertility decisions, and in general interplayed with education and contributed to the decline of family sizes. On the other hand, Sasson and Weinreb (2017) show that in Western Africa, in communities with already low and declining natural resources, the desire for additional children was high although variation existed between the rich and the poor. These examples illustrate the ambiguity associated with the relationships between fertility preferences and fertility outcomes and environmental stressors. Improving the understanding of this relationship is particularly important in light of the unabated global human population growth and the worsening environmental crisis.

Ethiopia is an interesting area to study fertility preferences in the context of environmental degradation, food insecurity and human population growth. It is the second most populous country in Africa, and its population has doubled from nearly 50 million people in 1990 to 100 million in 2015 (UN 2019), of which nearly half (47%) are children under the age of 15 years (CSA 2016). Since the 1990s, the government has implemented a series of interventions to slow down human population growth in the country, including an increase in the availability of family planning methods (Olson and Piller 2013) and legislation against underage marriage, along with efforts to expand and improve access to education and health care in rural areas (Hailemariam 2016). These efforts have led to a decrease in fertility rates to 2.3 children per woman in urban areas (CSA 2016). Nonetheless in rural areas, where the majority of people reside (ca. 78%, World Bank 2020), the total fertility rate is 5.2 children per woman (CSA 2016). In these areas, per capita average farm size is declining, and high fertility rates pose challenges not only for environmental conservation, but also for food security and the general welfare of households.

Our focal research area is located in Jimma zone, Oromia, in southwestern Ethiopia and includes four *kebeles* (smallest administrative unit) located in three *woredas* (districts, namely *Setema*, *Gumay*, and *Gera*). The landscape in this region of Ethiopia typically consists of a mosaic of agricultural land interspersed with scattered trees, live fences, homegardens, and small to large fragments of natural forests and shade coffee forests. Livelihoods are characterized by subsistence agriculture based on food crops mixed with the production of cash crops (i.e. coffee and khat) (Manlosa

et al. 2019a). Food insecurity is seasonally experienced by many households (for further details on food insecurity in the region see the study by Manlosa et al. (2019a). The agrarian and subsistence nature of livelihoods and substantial distance to larger towns classify the region as predominantly rural. Forests in the region support high biodiversity (Rodrigues et al. 2018, 2019; Shumi et al. 2019) and provide many important ecosystem goods and services (Dorresteijn et al. 2017), but have been progressively encroached upon by farmland since the 1970s, leading to a decrease in forest cover from 79 to 60% between 1973 and 2010 (Ango et al. 2020). Environmental degradation is also apparent in agricultural land through for example increased erosion and soil depletion (Taddese 2001). Human population in Jimma zone has increased by 26.7% between 1994 and 2007 (UNDP-EUE 2000; CSA 2010, author's own calculation).

In the state of Oromia, the fertility rate is 5.4 children per woman, and the proportion of married women using modern methods of family planning is around 28%, whereas the unmet need for family planning is estimated at 29% (CSA 2016). The median age at first marriage is 17.4 years, and of 19.1 at first birth (CSA 2016). About half of the population in Oromia is Muslim, and social organization reflects a male dominated society where patriarchal values and polygamy are common.

Methods

Sampling and data collection

The data for this study are based on a mixed methods approach, including a household survey of randomly selected women in four *kebeles* ($n=120$), and key informant interviews with local health experts ($n=5$) for background information on family planning services in the study area. The surveys were conducted in the local Oromo language in the *kebeles* by two trained female enumerators with backgrounds on health issues. The answers were translated into English by the enumerators. Interviews with health professionals in the *kebeles* were conducted in Oromo, and in English in the *woredas* (by choice of the interviewed health workers). Data collection took place in two periods: data for a pilot study were collected during July 2016; and the main survey was conducted between February and March 2017.

For the household survey, we used a face-to-face questionnaire for data collection. An initial pilot questionnaire was developed and tested in the rural setting with 22 women. This pilot survey helped to train the enumerators and allowed the fine-tuning of questions for the survey tool, especially regarding the wording in Oromo. We used proportional cluster sampling, meaning that the number of women surveyed in each *kebele* was proportional to the *kebele's* total

population, and we used a spatial map of all the roofs in the *kebeles* to randomly select our households. One woman was interviewed per household. This resulted in a survey of 159 women, but after exclusion of problematic and incomplete key answers, we included information for 120 women aged between 18 and 50 years in the analysis. We decided to focus on women only for three reasons. First, eliciting women's perceptions and preferences in relation to fertility is particularly important for patriarchal societies where men naturally have a stronger voice. Second, we intended to be sensitive to the local cultural context and to carefully engage with local people. By only engaging with women we avoided that talking about this sensitive issue would trigger tensions between women and men in a household. Finally, it is female bodies that are directly affected by pregnancy (and its associated risks) and the majority of modern contraception methods available in the study area.

We used the desired number of children and the use of family planning as indicators of fertility preferences, since the desired number of children gives an idea about future-oriented aspirations and use of family planning indicates a present-view of actions. However, although it is possible that the use of family planning does not always align with fertility preferences, for simplicity, we here refer to fertility preferences as encompassing both the desired number of children and the use of family planning. Further, the use of family planning methods refers to modern methods only (such as injectable, implants, the pill, condoms) and excluded traditional methods (such as the rhythm method or medicinal plants) since previous studies suggest that the former are used much more frequently than the latter (CSA 2016). Our questionnaire had both close-ended and open-ended questions regarding women's perceptions of different stressors and their fertility preferences. We selected a survey questionnaire over other research tools because we were interested in assessing and quantifying the potential effect of perceptions on fertility preferences. The close-ended questions included in the questionnaire allowed us to statistically model this potential effect, whereas the open-ended questions enabled us to capture qualitative explanations. The questionnaire consisted of twenty questions structured into five sections: (i) household background, (ii) perceptions, (iii) desired number of children, (iv) family planning use, and (v) aspirations and expectations for children (see Supporting Information Tool S1). Section i elicited the age of marriage, age at first child, education level, marital status, religion, current number of children and their education. Section ii assessed a respondent's perceptions regarding future trends (i.e. in the forthcoming ten years) in food security, environmental conditions, human population, and current perceptions of land scarcity. Questions on perceptions of future trends were asked on a Likert scale, from 1 to 5 ("much better" to "much worse", or, in the case of human population

growth, “decreasing a lot” to “increasing a lot”), and were followed by an open-ended question (“why?”) aimed at collecting a justification for the reported perceptions (see supporting information for details). Section *iii* focused on the desired number of children. Women were asked to report their desired number of children, why they would like to have more or fewer children than they already had, and about the benefits and disadvantages of having many or few children. Section *iv* asked about the use of contraceptives, and the frequency of use, as well as about women’s views on the advantages and disadvantages of contraceptive use. This section also included questions to understand spousal communication and fertility preferences. Section *v* examined women’s aspirations for their daughters and sons in terms of age of marriage. We included this section because (1) it could provide insights on the type of knowledge women will pass on to their children, and (2) it could help to understand whether women take into account potential concerns emerging from their perceptions in the aspirations they have for their children’s future.

Finally, we interviewed five rural health extension workers to assess (1) local availability of family planning methods; (2) acceptance and reasons for the uptake of family planning methods; and (3) outreach activities regarding family planning. We opted to conduct interviews with local health experts to obtain in-depth information about the context in relation to the above topics, which were not covered in the household questionnaire. Interviews were held with both female and male nurses from both *kebele* and *woreda* levels: three female nurses were interviewed in two *kebeles* in *Setema* and *Gumay woredas*, two male nurses were jointly interviewed at *Gatira* town (in *Setema woreda*), and one informal conversation was held with a female nurse in *Gera woreda*.

Data analysis

Our mixed-method approach included both quantitative and qualitative analyses (Fig. 1). The quantitative data analysis followed three main steps. First, we summarized respondents’ socio-demographic characteristics, perceptions, preferences and aspirations for their children using descriptive statistics. Second, we modeled the relationships between women’s perceptions, their background characteristics and two response variables, i.e. the desired number of children and the use of family planning. We used generalized linear models with a Poisson distribution to model the desired number of children, and a binomial distribution to model the use of family planning (use versus non-use). A set of different variables entered the models depending on the response variable of interest (see Table S1). The number of complete cases varied between questions and we, therefore, report the total and the partial number of respondents along

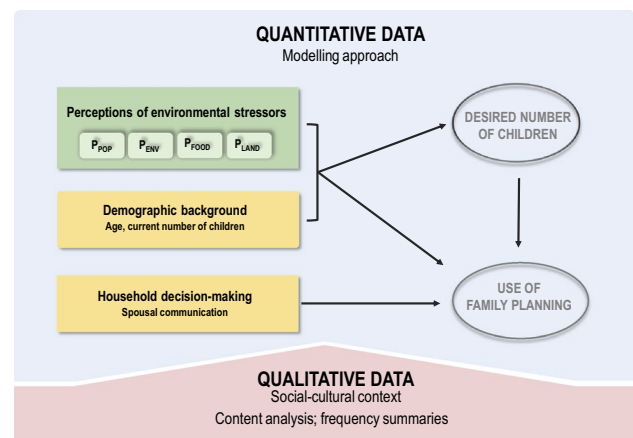


Fig. 1 Illustration of methodological approach. The role of perceptions of different stressors (green box) on fertility preferences (i.e. the desired number of children and the use of family planning), was assessed through a modelling approach using quantitative data derived from close-ended questions in the survey tool. Other known determinants of fertility preferences such as demographic background and household decision-making (yellow boxes) were also included in the modelling approach. Qualitative data were derived from open-ended questions in the survey tool and from information derived from interviews with key informants (i.e. health experts), and was used to complement the characterization of the underlying social-cultural context of the study area

with percentages. The aspired age of marriage for children was summarized using age classes (12–15 years, 16–17, 18–25, > 25). A few respondents reported an age interval (e.g. between 16 and 20 years old) rather than an absolute age value (i.e. at 15 years old). In these instances, the intervals reported were attributed to the age class with the largest overlap. The final step in our data analysis consisted of a content analysis of the qualitative data from open-ended questions, to capture information not represented by the quantitative data. Specifically, qualitative data were analyzed using a content reduction approach, based on summarizing content analysis (Mayring 2000). We first read all the answers to get familiar with the content. We then identified major coding units, at a second reading. Finally, we classified the answers according to the coding units (with answers allowed to have more than one coding unit), and we summarized their frequency.

Ethical considerations

Prior to our surveys, we obtained permission from *kebele* leaders and *woreda* officials to conduct the research. After a clear explanation of the research and data handling we sought voluntary informed consent from each participant of the survey. All respondents were informed of their right to terminate the interviews at any time. Consent was given verbally in the presence of a witness. Anonymity was

granted to all respondents during the period of study and in all outputs from the research. Respondents were differentiated using an alphanumeric ID. Research was approved by the Ethics Committee of Leuphana University.

Results

In this section, we first give an overview of the socio-economic characteristics of the respondents. We then provide a detailed account of women's perceptions of trends of different environmental stressors. We continue by presenting women's fertility preferences followed by the influence of perceptions on fertility preferences and the role of social-cultural factors within the broad context in shaping fertility preferences. Finally, quantitative findings are complemented by qualitative results from open-ended questions and interviews with health experts.

Socio-demographic characteristics of respondents

Approximately 85% of respondents were at least 25 years old. The vast majority were Muslim (97%) and illiterate (66%) or had only attended primary education (27%). Households had on average 7.2 ± 2.9 members (adults and children), and women had on average 4.8 ± 2.2 children (Table 1 and Table 2). Approximately 98% of respondents were married, and the average age at marriage was 15.5 ± 2.5 years (Table 2).

Table 1 Socio-demographic characteristics of female respondents in southwest Ethiopia

Characteristics	Frequency	Percent
Age respondents ($n = 118$)		
18–19	4	3.4
20–24	14	11.9
25–29	21	17.8
30–34	21	17.8
35–50	58	49.2
Religion ($n = 116$)		
Muslim	112	96.6
Orthodox	3	2.6
Protestant	1	0.9
Education attainment ($n = 100$)		
No education	66	66.0
1 to 6th grade	27	27.0
7 to 12th grade	7	7.0
College	0	0

Table 2 Reproductive history of female respondents

Characteristics	Frequency	Percent
Age at first marriage ($n = 114$)		
≤ 15	66	57.9
16–17	30	26.3
≥ 18	18	15.8
Age at first birth ($n = 113$)		
≤ 15	15	13.3
16–17	45	39.8
≥ 18	53	46.9
Number of live children ($n = 120$)		
≤ 2	19	15.8
3–5	50	41.7
≥ 6	51	42.5
Family size ($n = 120$)		
≤ 4	17	14.2
5–9	86	71.7
≥ 10	17	14.2

Women's perceptions of environmental stressors

Perceptions of food security trends

The majority of respondents (74% of $n = 120$) expected an overall improvement in the food security of their household within the next ten years (Fig. 2a). The reasons given for expected improvements were associated with the notion of “working hard”, which was reported by 69% of rural respondents. The idea of “hard work” refers to strong dedication expressed in committing substantial time for working and diversification of livelihood activities that can lead to an increase in farm production and enable future investment. Respondents mentioned the importance of sowing and harvesting on time, sharecropping, diversifying products and the performance of off-farm income generating activities as forms of hard work: “*Through hard work. There is a shortage of land but we try to improve our production by intercropping crops like maize, coffee and sorghum, and by trading khat and coffee*” [R43]. The use of improved crop varieties, fertilizer and access to knowledge and technology were also perceived to contribute to expected future improvements in rural food security. Respondents who expected a deterioration of food security (17%) identified crop raiding by wild animals and land scarcity as the main reasons for such deterioration.

Respondents were then asked about the relationship between their family size and the amount of food produced by the household and the amount of food that each individual in the family was able to consume. Perceptions were mixed and varied among respondents. About 30% of respondents perceived a positive effect or a beneficial relationship

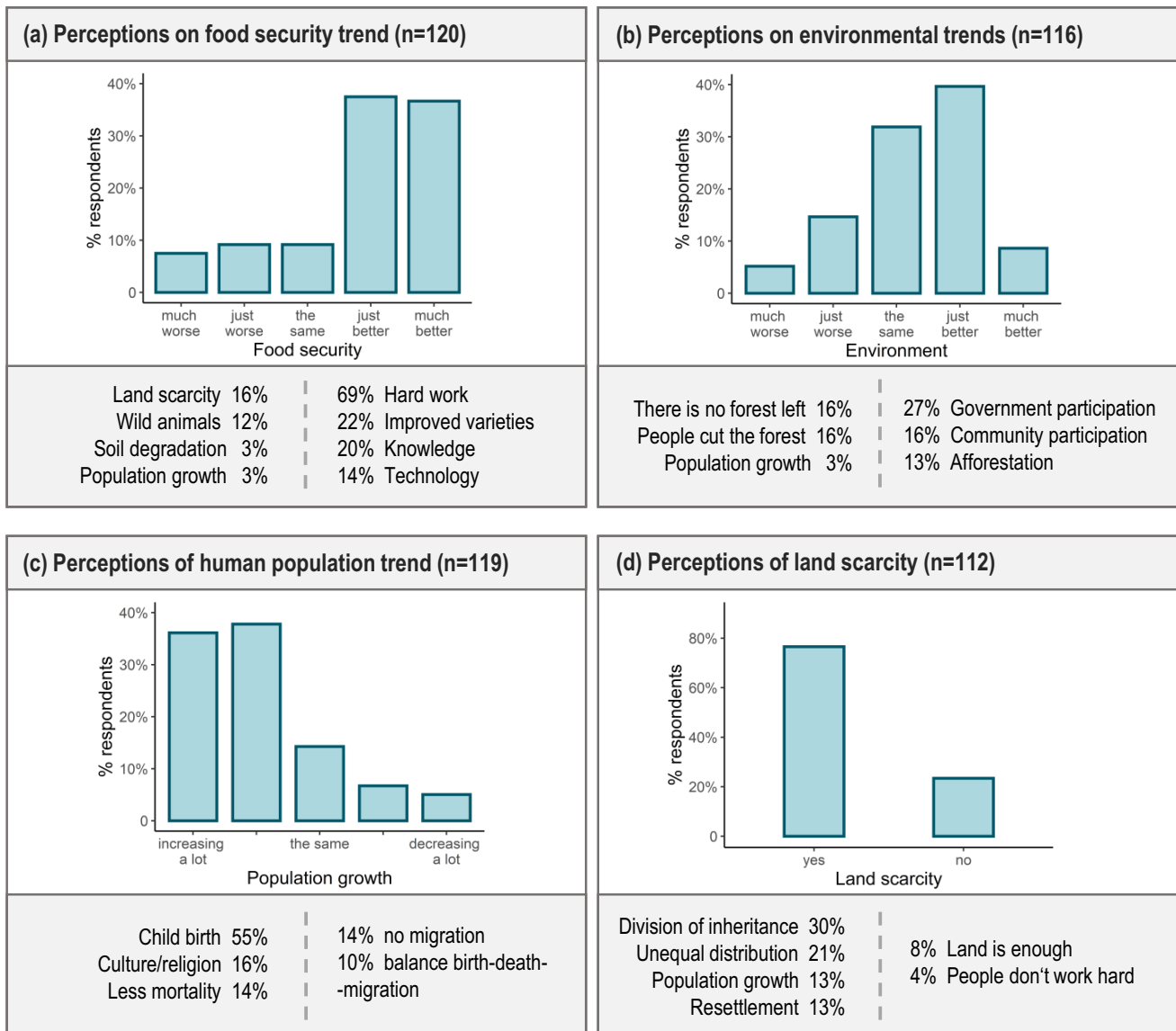


Fig. 2 Summary of perceptions on future trends in **a** food security, **b** environmental conditions, **c** human population growth and **d** current trends in land scarcity. The panel below each plot lists the main topics reported by respondents as contributing to the perceived trends.

The proportion of respondents mentioning each topic is given either on the left or right of the topic. Dashed lines in between topics separates reasons for “yes–no”, “better–worse”, and “increasing–decreasing” gradients

between the family size (and having children in the family) and the food produced by the household. The positive relationship resulted from the contribution of children with labour in the fields and in the household, as illustrated by the following statement: “Children help during sowing, harvesting and by protecting our crops from wild animals on field. Children have an important role during production. Our crop production improved due to children’s assistance.” [R22]. On the other hand, about 33% of respondents mentioned that the size of the family (and the children in the family) had no influence on production, mostly because children were still too young to help the family with their

labour or because the family size was too small to have an influence.

Further, when asked about the effect of family size on the amount of food that each individual was able to consume, about 38% of rural respondents perceived no relationship between household size and the food available for consumption, with some reporting that food was enough, and that their family size was small relative to their assets, and with a few respondents mentioning problems with damages to crops due to wild animals, soil degradation and land scarcity. This is illustrated by the following statement: “No, the size of the family doesn’t affect the intake of our food. The

problem is we cannot harvest our expected yield due to crop damage by wild animals. Therefore, our family size doesn't matter for our food intake, but we eat less or skip meals due to crop loss caused by animals" [R121]. Nearly 30% of rural respondents perceived a negative effect of household size on food availability, with some explaining that their harvest was insufficient and with many reporting that adults and children skip meals or consume less food per meal: "*Yes it [household size] has a negative effect on food ... because our production is not enough for my family. Sometimes they consume less due to shortage of food in the house*" [R38]. 31% of respondents were ambiguous about the existence of such a relationship, but often reported that skipping meals or eating smaller meals was common among adults and children during periods of food shortage.

Perceptions of environmental trends

About half of the respondents (48% of $n = 116$) expected improvements in the environmental conditions of their *kebele*, whereas about 32% expected no changes. Government afforestation initiatives and regulation of the use and extraction of forest products, together with increasing community participation in forest protection were identified as key factors underpinning expected improvements in the environment (Fig. 1b): "*Most people need to plant coffee in the forest and need shade trees, and government made a law for forest protection. If someone cuts trees from the forest, they will receive punishment*" [R41]. Respondents expecting no change in the environment commonly reported a lack of forest in the area around their house. Among the respondents who perceived some level of deterioration in their environment (ca. 20%), the destruction of forest was reported as the main reason for the degradation of environmental conditions. Deforestation was perceived to be the result of the need to expand farmland area and to build new houses: "*People started to clear land to build their home and to expand their farmland for production; the forest is shrinking rapidly*" [R45].

Perceptions of human population growth

Most respondents (74% of $n = 119$) expected an overall increase in the regional population (Fig. 2c). Childbirth was identified as the main reason for such an increase (reported by 55% of respondents), combined with low child mortality (Fig. 2c). Other reasons, mentioned by 16% of respondents, included cultural or religious motives such as early marriage of girls, no use of family planning methods due to religious beliefs, polygamy, and the Sharia law. Two respondents mentioned: "*95% of people in our kebele abide by Sharia law. Girls and boys are getting married at an early age*" [R139]; "*Many women give birth without having a gap and without*

using family planning method because it's not permitted by God to limit the amount of children obtained" [R115].

Perceptions and influence of land scarcity

Most respondents (77% of $n = 112$) perceived that land available for farming was scarce in their *kebele*, especially for the younger generation. Large family sizes, inheritance practices, and limited options for acquiring new land were identified as the main reasons: "*In our area one husband can have three wives, from three wives he gets many children. During division of land for inheritance, some children are unable to get land*" [R84]. Respondents also noted the unequal distribution of land during the Derg regime (after 1975), human population growth, resettlement of people and issues related with land transactions (e.g. when people migrate and lend their land) (Fig. 2d). 23% of respondents perceived no land scarcity in their *kebele* with a few providing justifications mentioning large family sizes and inheritance practices and the lack of will to work the land as general factors associated with issues of land scarcity: "*There is enough land in our area but people don't want to work on it*" [R10]; "*Most people have [small plots of] land but have many children and their children do not get land after division (...)*" [R3]. Asked about the relationship between land availability and fertility decisions, 61% of rural respondents (of $n = 119$) reported no perceived relationship, with nearly half of them mentioning religious motivations for having children: "*Because in our religion having children does not depend on having land or wealth, it is God/Allah's will*" [R18]. The possibility of having other options, such as sharecropping when land is lacking was also noted by some respondents: "*If people have no land they can work and produce crops with other people to get a share of the production and the size of land doesn't affect the family size*" [R23]. The other share of respondents (39%, of $n = 119$) reported a perceived effect of the amount of available farmland on fertility, with land availability related to the ability to support more children and as an important asset for food production and for children's future security through inheritance.

Women's fertility preferences and their determinants

Fertility preferences

On average, rural respondents reported 6.1 ± 2.6 children as their desired number. Around 56% of respondents reported wanting to have more children, 18% reported wanting to have fewer children (than the ones they already have), and 25% report they already have their desired number of children. Less than half of rural respondents (44% of $n = 120$) reported to have used family planning methods at some point in their

lives. The frequency of contraceptive use varied between “rarely” (34% of users), “sometimes” (26% of users), and “often” (26% of users). Hormonal injections and combined methods (contraceptive pills, injections and patch) were the most frequently used methods. In terms of the advantages and disadvantages of using family planning methods, rural women reported benefits for the health of mother and child, spending less time being pregnant and breastfeeding, being able to take care of children, and benefits for the family economy (Table S2). Side-effects dominated the identified disadvantages (Table S2).

Modelling the influence of perceptions on fertility preferences

The desired number of children of respondents was significantly and positively associated with the respondent’s current number of children ($\beta=0.044$, $p<0.05$) and with a perception of increasing human population growth ($\beta=0.107$, $p<0.01$) (Table 3). In addition, women who discussed fertility preferences with their husbands ($\beta=1.421$, $p<0.01$) were more likely to use birth control compared to those who did not discuss fertility preferences with their husbands (Table 3).

Social-cultural factors

Four main social-cultural topics emerged from the combination of the quantitative summaries and qualitative analysis along the questionnaire, as relevant in the context of fertility preferences: utilitarian value of children, religious beliefs, spousal communication and underage

marriage of girls. Most respondents (80% of $n=80$) indicated the help that children can provide (e.g. work in the fields, household chores and financial support once they become adults) as advantages of having more children than the ones they already had. Happiness was the second most frequently reported advantage of having more children (50% of $n=80$) followed by receiving Allah’s or God’s will (29% of $n=80$) (Table 4). Disadvantages of having many children included the lack of material resources to support children (e.g. clothes and school supplies), parents being frequently tired, and a lack of time to look after children (Table 4). Some of the respondents reporting discussing family planning with the husband mentioned the importance of joint decision-making in deciding the gap between births, deciding the number of children and in preventing disagreement between husband and wife. Women who did not discuss with their husband and that reported reasons mentioned the lack of need to discuss because they were not interested in using family planning and because the use of family planning goes against their religion.

Respondents’ aspirations for the age at which their children would get married differed according to the gender of the child (Fig. 3). Around 42% of women aspired for their daughters to be married before the legal age of 18 years. Respondents who aspired for their daughters to marry while underage, and that provided reasons, explained that the culture and the desire to follow the Sharia law were the primary motivations. The aspired age of marriage for sons was higher than the one for daughters (Fig. 3). Respondents reasoned that prior to entering marriage, sons should have work and savings to support their new family.

Table 3 Summary of generalized linear models, assessing the relationships between perceptions and fertility preferences

Summary of models										
	Intercept	Age	Current children	Desired children	Discuss husband [#]	P_{POP}	P_{FOOD}	$P_{LAND}^{\#}$	P_{ENV}	Explained deviance (%)
Desired n. of children ($n=103$)	0.944***	0.011	0.044*	n.a	n.a	0.107**	-0.026	-0.107	-0.008	24
Use of family planning ($n=98$)	0.926	-0.014	0.089	-0.176	1.421**	0.018	-0.258	0.100	-0.206	14

P_{ENV} perceptions on environment, P_{FOOD} perceptions on food security, P_{POP} perceptions human population growth, P_{LS} perceptions on land scarcity

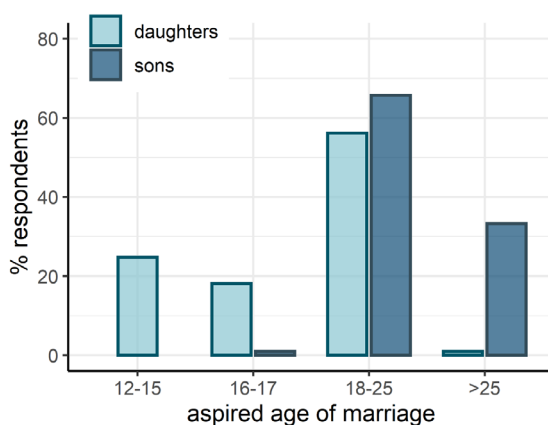
Codes for the significance levels: *** $p<0.001$, ** $p<0.01$, * $p<0.05$. n.a: non-applicable, variables that were not included in the model

[#]Discuss with husband and perception of land scarcity (P_{LAND}): rural respondents reported *yes* or *no*. Reference level in the models is *no*

Table 4 Summary of benefits and disadvantages of having more or fewer children than the reference point

Benefits and disadvantages of having <u>more</u> children than the reference	
Benefits	<i>n</i> = 80
Children help in the fields and help with money	64 (80%)
Children bring happiness	40 (50%)
Substitution in case of death—"if one child dies we have more"	23 (29%)
It is God 's / Allah 's will	23 (29%)
Children increase the number of relatives	12 (15%)
Children represent insurance at old age	9 (11%)
Children are a sign of respect in the community	6 (8%)
Others	3 (4%)
Disadvantages	<i>n</i> = 88
There is not enough money to buy clothes, school materials	65 (74%)
Children make parents tired	41 (47%)
There is no time to take care of children (e.g. give bath)	33 (38%)
It is difficult to provide food	21 (24%)
There is land competition between children	20 (23%)
It negatively impacts the health of the mother and the child	10 (11%)
Others	13 (15%)
Benefits and disadvantages of having <u>less</u> children than the reference	
Benefits	<i>n</i> = 30
It is difficult to provide goods for many children	22 (73%)
I know I have enough to provide only for few children	17 (57%)
It is good for the children and mothers health	14 (47%)
It is God 's / Allah 's will	1 (3%)
Disadvantages	<i>n</i> = 42
There are no disadvantages	25 (60%)
Decreases the amount of labour	14 (33%)
Decreases the amount of relatives	5 (12%)

The reference level is the current number of children. Numbers refer to absolute counts of women who reported each benefit or disadvantage



"According to the Sharia law, women should get married starting at 12 to 15 years and for men, starting at 20 years old, they can get married" [R25]

"For her it is a shame to marry later than 15-20 years old. For him no problem to marry at whatever age" [R64]

"For our daughter, she should get married at this age [15 or 16 years old] according to Sharia rule and our culture. For my son, after he completes his education and has his own work and after he helps me" [R92]

"The girls shouldn't get married before the age of 20 because they can't give birth, they get difficulty during birth [face additional risks when young]. The boys have to identify how they can support their family" [R35]

Fig. 3 Female aspirations for their children in terms of age of marriage, disaggregated by child gender and respondent setting

Availability of family planning services and outreach activities

Health workers indicated that family planning methods had been freely available at the *kebeles'* health clinics since the late 2000s. Two nurses from one *woreda* identified compliance with religious rules as one of the main constraints to the use of family planning methods, in addition to fear and misinformation about side effects. A health worker from another *woreda* identified male dominance and lack of women's agency as factors limiting the uptake of contraception. The absence of engagement with reproductive health issues among community and religious leaders were also reported by the same health worker as obstacles to the uptake of family planning methods. Health workers also reported inconsistency in the use of family planning methods, regarding the use of short-term methods (such as injections and pills). Healthcare providers perceived illiteracy as an important factor in inconsistency of use because illiterate women were unable to read their health schedule and were more likely to miss their healthcare appointments. At the *kebele* level, nurses similarly reported the influence of religion and of husbands on the uptake of contraception. Notably, *kebele* and *woreda* nurses suggested that unsupportive social norms appeared to be changing, and that communities and leaders were beginning to gain a better understanding of the side effects and the advantages of family planning, but this change seems to happen at a different pace in different locations. Two nurses from the same *kebele* reported a wide acceptance of family planning and mentioned that many people are using it on their own will whereas another health worker, from another *kebele* reported that acceptability has been increasing but is not yet prevalent.

The reported outreach activities differed between *woredas*. *Setema* health workers reported outreach interventions that included engaging with community and religious leaders, and the use of school media at elementary and high school education levels to disseminate information regarding family planning. Furthermore, nurses from *Setema* and *Gumay woredas* reported regular visits to the *kebeles'* households. A health worker from *Gera* mentioned the absence of outreach activities engaging with community and religious leaders and stressed the need to include men in interventions that target family planning.

Discussion

This study examined fertility preferences of rural women in relation to perceptions of future trends of key environmental stressors affecting local livelihoods (i.e. environmental degradation, food insecurity, land scarcity and human population growth) and in relation to social-cultural factors. Our

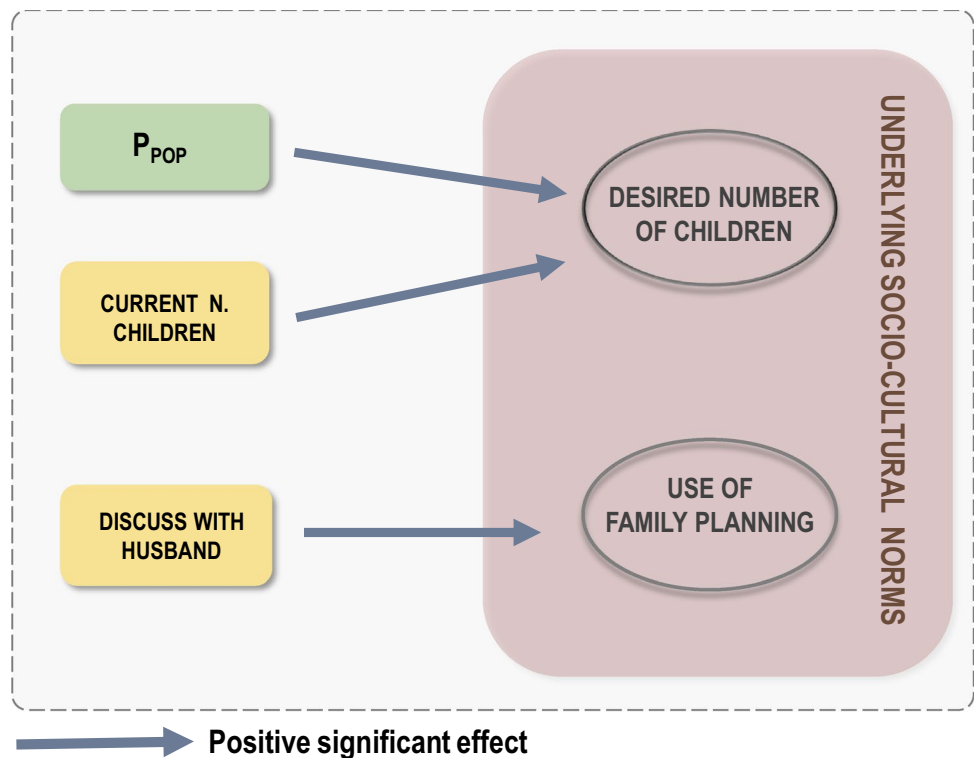
findings are synthesized in Fig. 4. Overall, the quantitative results indicate that perceptions of future trends in human population growth had a positive effect on fertility preferences, and that perceptions of the remaining environmental stressors had little influence on women's fertility preferences. The quantitative results also indicate that the number of children already born was linked to a desire for more children, whereas joint decision-making with the husband was linked to the more likely use of contraception. Further, findings from the qualitative analysis indicate that social-cultural aspects held at the community level, such as religious influence, underage marriage, and male-dominance in the household, as well as a widely held view of the utilitarian value of children, influenced women's fertility preferences in the region. Our results have implications for the development of policies and interventions aiming to encourage and promote the acceptance and voluntary use of modern family planning methods and the slowdown of human population growth.

Perceptions of environmental stressors

Previous research in our study area shows that rural households experience numerous stressors that can impede their livelihoods. For instance, during food shortages in the lean season, households often reduce the intake of food (Manlosa et al. 2019a). Findings from this study confirm perceived land scarcity for farming activities. However, despite this, the majority of respondents expected an improvement in food security in the next ten years. This perception rests not only on a prevailing ethic to "work hard", either by devoting more effort to farming activities or by diversifying livelihoods, but also on the use of technology, knowledge and improved crop varieties, irrespective of environmental constraints.

Similar patterns emerged for perceived environmental trends. Past trends in forest cover show progressive deforestation and degradation of natural forests at least since the 1970s (Hylander et al. 2013; Ango et al. 2020). However, the majority of respondents perceived an improvement in forest cover in their *kebeles*. This perception was based on afforestation initiatives promoted by the government, on the enforcement of forest protection laws and training and awareness campaigns directed to the community, as well as community engagement in forest protection activities. Whereas human population growth is seen as an underlying pressure on the natural environment and likely to exacerbate food insecurity globally (Dasgupta 1995; Godfray et al. 2010; Crist et al. 2017), locally, many women expected improvements in their food security and in the future state of natural resources, despite also acknowledging ongoing human population growth. Thus, our findings suggest a disconnection between what is perceived locally versus global

Fig. 4 Synthesis of the variables influencing fertility preferences (i.e. the desired number of children and the use of family planning) by rural female respondents



discourses on human population growth and the environment; and arguably a disconnection between local perceptions and measurable indices of environmental degradation, such as forest clearing. However, further research is needed to disentangle the relationships between local perceptions and indices of degradation because despite the documented forest clearing in the region (Hylander et al. 2013; Ango et al. 2020), a series of landscape restoration initiatives are being implemented across the country (Abera et al. 2020).

Determinants of fertility preferences

We discuss two potentially important determinants of women’s fertility preferences—perceptions about future environmental stressors and social-cultural factors. Generally speaking, the perception of future stressors seemed to only poorly explain fertility preferences. Indeed, the influence of perceptions on fertility preferences of women was limited to the perception of future trends in human population growth. Respondents who expected ongoing human population growth were more likely to desire more children than women who did not share this expectation. Similarly, the current number of children had a positive effect on the desired number of children of respondents. Among various possibilities, both relationships can be the result of social norms and cultural values that incentivize large family sizes. This approximates what Barrett et al. (2020) described as “conformist” reproductive behaviour, that is, “when the family size that a

household desires is positively related to the average family size in the community”, so that it conforms with the community norm. In addition to this potential “conformist” view, it is also possible that large family sizes can be beneficial for households in terms of access and availability to labour and in terms of future security (in some dimensions). Further, and as perceived by urban residents in Ethiopia, “rural and illiterate households” may invest in larger family sizes in pursuit of higher social status and respect in the community (Sahleyesus et al. 2009). Furthermore, in the rural context of southwestern Ethiopia, where gendered social norms are still strong (Manlosa et al. 2019b) with men as the primary decision-makers and mainly responsible for the farm and the production of food, and women responsible for household chores and attending to children, narratives on environmental degradation and declining crop production may not be rationales on which the majority of women would base their fertility preferences.

Indeed, social-cultural norms and mindsets appeared to be strong underlying forces influencing fertility preferences in the study area. Local mindsets around the utilitarian value of children (i.e. extra labour that can contribute to the household economy), around children as a divine will, or around children as an “insurance in old age” that can help with money and knowledge when adults, were frequently mentioned, and are consistent with descriptions for sub-Saharan Africa—(see the review of Dyer (2007) on the value of children in Africa, but derived from studies in infertility).

A minority of respondents also held the view that once born, a child “*grows up by taking its chances or opportunities*”, which according to Newmarch and Bekere (2016) means that if children have luck they can succeed through life, a finding similarly reported by urban residents of Jimma in the study of Sahleyesus et al. (2009). An important point to raise here is the potential influence of children already born on the desired number of children reported. It is possible that women who desired the same number of children might feel uncomfortable reporting they would have desired fewer children because these children are already born, in what Bongaarts and Casterline (2013) call a “rationalization bias”. However, our results show that 18% of women do report wanting fewer children, either because women consider only having enough means to support a small family, because it is difficult to provide care and goods for many children, or because it is beneficial for the health of both mother and child.

Another important and pervasive social norm elicited from respondents’ statements was the support for underage marriage of girls. Almost half of the respondents expected their daughters to get married before the age of 18 years, and about a fourth preferring an age between 12 and 15 years. Younger marriage ages in girls can result in earlier motherhood and potentially in larger families (Wodon et al. 2018; Efevbera et al. 2019). Further, and as highlighted by the Population Reference Bureau (2015) “*early marriage undermines the rights and livelihood opportunities of girls by leaving them vulnerable to the health risks of early pregnancy and childbearing, and by prematurely ending their schooling*”. For instance, Delprato and colleagues (2015) show that the years of primary education attendance could increase by 39% if marriage of girls was delayed to the legal age and Omoeva and Hatch (2020) show that in East Africa, married adolescent girls are 31% less likely to be engaged in school compared to unmarried adolescent girls.

Another key determinant in the use of family planning methods was whether women discussed family planning with their husbands—a topic identified as important in many sub-Saharan African countries (reviewed in Blackstone et al. 2017). In our study, women who reported discussing family planning with their husbands were more likely to use family planning methods than those who did not. For this group of respondents, discussing with the husband was important not only to decide on the number of children and the gap between births, but also to prevent disagreement between husband and wife. Further, while some respondents mentioned that when faced with disagreement with the husband they would still follow their own will, for others their will would be overruled by the husband’s decision, as “*giving respect for husband is our culture*”. This highlights the importance of including husbands in future research in the region aiming to understand fertility preferences and fertility

outcomes. Indeed, considerable research in sub-Saharan Africa confirms that the inclusion of husbands in the process of decision-making increases the likelihood of the use of family planning (Terefe and Larson 1993; Bawah 2002; Ezeanolue et al. 2015). Overall, our findings illustrate that in addition to women’s choice and to the joy and happiness brought by children, fertility preferences are also influenced by social-cultural factors, such as norms and mindsets and gender-power relations within the household (Kane et al. 2016).

Implications

The findings from our study are of significance for policy and practice. Here, we found a mismatch between the global discourse on the population–environment–food nexus (Crist et al. 2017) and local women’s perceptions. This mismatch can have implications for the implementation of policies relating to demography, sustainable use of natural resources and livelihoods. This is because policies are typically developed at the national scale (and often are internationally influenced), but they are implemented at the local level, and, therefore, such mismatches in discourses and understandings can result in the design of inappropriate and ineffective policies and consequently in the misallocation of resources. Understanding and tackling underlying paradigms (such as “hard work”) that contribute to the disassociation of knowledge among scales is, therefore, critical for the design and prioritization of appropriate interventions.

Likewise, our study highlights the need to consider the socio-economic and cultural context in which fertility preferences are based and fertility decisions taken. Ethiopia’s cultural background is extremely diverse, with more than 80 ethnic groups and more than 80 languages, five widespread religions and many traditional faiths (Adamu 2013). Such a diversity of cultures implies that many different views, motivations and desires can be held regarding fertility preferences. Despite significant improvements in education and access to reproductive health care in the study area (Assefa et al. 2019), the desired number of children (currently 6.0) is well above the replacement rate of 2.1 (Searchinger et al. 2013) while the unmet need for family planning (currently at 29%, CSA 2016) is still high. These indicators suggest that the transition from high to low fertility rates will require more than technical interventions—such as improving the availability of family planning methods.

In the presence of strong and deep forces such as social-cultural norms, technical interventions alone are unlikely to trigger and sustain profound changes in fertility preferences and fertility outcomes (Abson et al. 2017). Therefore, and given the important role of social norms demonstrated in this paper and elsewhere (Nyborg et al. 2016), new deliberative approaches are needed to engage with those social

norms that currently incentivize unsustainably large family sizes, to the possible detriment of both children and women. Despite this knowledge, the majority of interventions to slow down population growth continue to be oriented towards population control and the administration of contraceptives. The findings of this study point to the need to shift from a discourse of population control through contraceptives to one rooted on deliberative approaches and community-led critical reflections on norms and on helping women and men engage in shared decision-making about their family size. As discussed in Kane et al. (2016), deliberative approaches that promote inclusive conversations among boys and girls, couples, parents (Coast et al. 2019), and the wider community and society should be encouraged; these should engage with topics such as social norms and cultural beliefs, family planning and adolescent health services (Coast et al. 2019) and education (McClendon et al. 2018). Importantly, as cautioned by Boyden and colleagues (2012), such approaches should identify and address the rationale behind the prevailing norms to prevent undesired outcomes. Information shared by health workers and by a previous study in the region (Manlosa et al. 2019b) show that a shift towards this direction is already being observed. However, for widespread change to happen, stronger governmental support and adequate investment to design and facilitate participatory processes is needed. Only through a broader household and community-level shift in norms and relations can the potential of family planning to slow down population growth be realised. Carrying on with business as usual, it seems, will not be a sustainable path for the region.

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References

- Abera W, Tamene L, Tibebe D et al (2020) Characterizing and evaluating the impacts of national land restoration initiatives on ecosystem services in Ethiopia. *Land Degrad Dev* 31:37–52. <https://doi.org/10.1002/ldr.3424>
- Abernethy VD (1997) The right incentive: how perceived scarcity may stop population growth in time. *Politics Life Sci* 16:193–195. <https://doi.org/10.1017/S0730938400024540>
- Abson DJ, Fischer J, Leventon J et al (2017) Leverage points for sustainability transformation. *Ambio* 46:30–39. <https://doi.org/10.1007/s13280-016-0800-y>
- Adamu AY (2013) Diversity in Ethiopia: a historical overview of political challenges. *Int J Commun Divers* 12(3):17–27. <https://doi.org/10.18848/2327-0004/CGP/v12i03/39924>
- Admassie A (2002) Explaining the high incidence of child labour in Sub-Saharan Africa. *Afr Dev Rev* 14:251–275. <https://doi.org/10.1111/1467-8268.00054>
- Adsera A (2006) Religion and changes in family-size norms in developed countries. *Rev Relig Res* 47:271–286
- Ahmed S, Choi Y, Rimon JG et al (2019) Trends in contraceptive prevalence rates in sub-Saharan Africa since the 2012 London Summit on Family Planning: results from repeated cross-sectional surveys. *Lancet Glob Health* 7:e904–e911. [https://doi.org/10.1016/S2214-109X\(19\)30200-1](https://doi.org/10.1016/S2214-109X(19)30200-1)
- Ango TG, Hylander K, Börjeson L (2020) Processes of forest cover change since 1958 in the coffee-producing areas of Southwest Ethiopia. *Land* 9:278. <https://doi.org/10.3390/land9080278>
- Assefa Y, Gelaw YA, Hill PS et al (2019) Community health extension program of Ethiopia, 2003–2018: successes and challenges toward universal coverage for primary healthcare services. *Glob Health* 15:24. <https://doi.org/10.1186/s12992-019-0470-1>
- Barrett S, Dasgupta A, Dasgupta P et al (2020) Social dimensions of fertility behavior and consumption patterns in the Anthropocene. *Proc Natl Acad Sci USA*. <https://doi.org/10.1073/pnas.1909857117>
- Bawah AA (2002) Spousal communication and family planning behavior in Navrongo: a longitudinal assessment. *Stud Fam Plann* 33:185–194. <https://doi.org/10.1111/j.1728-4465.2002.00185.x>
- Bennett NJ (2016) Using perceptions as evidence to improve conservation and environmental management: perceptions and conservation. *Conserv Biol* 30:582–592. <https://doi.org/10.1111/cobi.12681>
- Biddlecom AE, Axinn WG, Barber JS (2005) Environmental effects on family size preferences and subsequent reproductive behavior in Nepal. *Popul Environ* 26:583–621. <https://doi.org/10.1007/s11111-005-1874-9>
- Blackstone SR, Nwaozuru U, Iwelunmor J (2017) Factors influencing contraceptive use in Sub-Saharan Africa: a systematic review. *Int Q Commun Health Educ* 37:79–91. <https://doi.org/10.1177/0272684X16685254>
- Bongaarts J (2017) Africa's unique fertility transition. *Popul Dev Rev* 43:39–58. <https://doi.org/10.1111/j.1728-4457.2016.00164.x>
- Bongaarts J (2003) Completing the fertility transition in the developing world: the role of educational differences and fertility preferences. *Popul Stud* 57:321–335

- Bongaarts J (2010) The causes of educational differences in fertility in Sub-Saharan Africa. *Populationyearbook* 8:31–50. <https://doi.org/10.1553/populationyearbook2010s31>
- Bongaarts J, Casterline J (2013) Fertility transition: is sub-Saharan Africa different? *Popul Dev Rev* 38:153–168. <https://doi.org/10.1111/j.1728-4457.2013.00557.x>
- Bongaarts J, Mensch BS, Blanc AK (2017) Trends in the age at reproductive transitions in the developing world: the role of education. *Popul Stud* 71:139–154. <https://doi.org/10.1080/00324728.2017.1291986>
- Boyden J, Pankhurst A, Tarefe Y (2012) Child protection and harmful traditional practices: female early marriage and genital modification in Ethiopia. *Dev Pract* 22(4):510–522. <https://doi.org/10.1080/09614524.2012.672957>
- Brauner-Otto SR, Axinn WG (2017) Natural resource collection and desired family size: a longitudinal test of environment-population theories. *Popul Environ* 38:381–406. <https://doi.org/10.1007/s11111-016-0267-6>
- Caldwell JC, Caldwell P (1987) The cultural context of high fertility in sub-Saharan Africa. *Popul Dev Rev* 13:409–437. <https://doi.org/10.2307/1973133>
- Coast E, Jones N, Francoise UM et al (2019) Adolescent sexual and reproductive health in Ethiopia and Rwanda: a qualitative exploration of the role of social norms. *SAGE Open* 9:215824401983358. <https://doi.org/10.1177/2158244019833587>
- Central Statistical Agency (CSA) (2010) The 2007 population and housing census of Ethiopia: statistical report for Oromiya Region; Part I: Population size and characteristics
- Crist E, Mora C, Engelman R (2017) The interaction of human population, food production, and biodiversity protection. *Science* 356(6335):260–264
- CSA (2016) Central Statistical Agency. Ethiopia Demographic and Health Survey 2016. Addis Ababa, Ethiopia, and Rockville, Maryland, USA: CSA and ICF
- Dasgupta PS (1995) Population, poverty and the local environment. *Sci Am* 272:40–45. <https://doi.org/10.1038/scientificamerican0295-40>
- de Sherbinin A, VanWey LK, McSweeney K et al (2008) Rural household demographics, livelihoods and the environment. *Glob Environ Chang* 18:38–53. <https://doi.org/10.1016/j.gloenvcha.2007.05.005>
- Díaz S, Settele J, Brondizio ES et al (2019) Pervasive human-driven decline of life on Earth points to the need for transformative change. *Science* 366:eaax3100. <https://doi.org/10.1126/science.aax3100>
- DiClemente K, Grace K, Kershaw T et al (2021) Investigating the relationship between food insecurity and fertility preferences in Tanzania. *Matern Child Health J* 25:302–310. <https://doi.org/10.1007/s10995-020-03022-1>
- Dorresteijn I, Schultner J, Collier NF et al (2017) Disaggregating ecosystem services and disservices in the cultural landscapes of southwestern Ethiopia: a study of rural perceptions. *Landscape Ecol* 32:2151–2165. <https://doi.org/10.1007/s10980-017-0552-5>
- Delprato M, Akyeampong K, Sabates R, Hernandez-Fernandez J (2015) On the impact of early marriage on schooling outcomes in Sub-Saharan Africa and South West Asia. *Int J Educ Dev* 44:42–55. <https://doi.org/10.1016/j.ijedudev.2015.06.001>
- Dyer SJ (2007) The value of children in African countries – insights from studies on infertility. *J Psychosom Obstet Gynecol* 28:69–77. <https://doi.org/10.1080/01674820701409959>
- Dynes M, Stephenson R, Rubardt M, Bartel D (2012) The influence of perceptions of community norms on current contraceptive use among men and women in Ethiopia and Kenya. *Health Place* 18:766–773. <https://doi.org/10.1016/j.healthplace.2012.04.006>
- Efevbera Y, Bhabha J, Farmer P, Fink G (2019) Girl child marriage, socioeconomic status, and undernutrition: evidence from 35 countries in Sub-Saharan Africa. *BMC Med* 17:55. <https://doi.org/10.1186/s12916-019-1279-8>
- Ezeanolue EE, Iwelunmor J, Asaolu I et al (2015) Impact of male partner’s awareness and support for contraceptives on female intent to use contraceptives in southeast Nigeria. *BMC Public Health* 15:879. <https://doi.org/10.1186/s12889-015-2216-1>
- Ezra M (2001) Demographic responses to environmental stress in the drought- and famine-prone areas of northern Ethiopia. *Int J Popul Geogr* 7:259–279. <https://doi.org/10.1002/ijpg.226>
- FAO, IFAD, UNICEF, WFP and WHO. 2019. The State of Food Security and Nutrition in the World 2019. Safeguarding against economic slowdowns and downturns. Rome, FAO
- Ghimire DJ, Mohai P (2005) Environmentalism and contraceptive use: how people in less developed settings approach environmental issues. *Popul Environ* 27:29–61. <https://doi.org/10.1007/s11111-005-0012-z>
- Godfray HCJ, Beddington JR, Crute IR et al (2010) Food security: the challenge of feeding 9 billion people. *Science* 327:812–818. <https://doi.org/10.1126/science.1185383>
- Grace K, Lerner AM, Mikal J, Sangli G (2017) A qualitative investigation of childbearing and seasonal hunger in peri-urban Ouagadougou, Burkina Faso. *Popul Environ* 38:369–380. <https://doi.org/10.1007/s11111-016-0268-5>
- Hailemariam A (2016) Implementation of the population policy of Ethiopia: achievements and challenges. *Population Horizons* 13:19–30. <https://doi.org/10.1515/pophzn-2016-0002>
- Hall C, Dawson TP, Macdiarmid JI et al (2017) The impact of population growth and climate change on food security in Africa: looking ahead to 2050. *Int J Agric Sustain* 15:124–135. <https://doi.org/10.1080/14735903.2017.1293929>
- Heaton TB (2011) Does religion influence fertility in developing countries. *Popul Res Policy Rev* 30:449–465. <https://doi.org/10.1007/s11113-010-9196-8>
- Hylland K, Nemomissa S, Delrue J, Enkosa W (2013) Effects of coffee management on deforestation rates and forest integrity: coffee and deforestation. *Conserv Biol* 27:1031–1040. <https://doi.org/10.1111/cobi.12079>
- Ikamari LDE (2005) The effect of education on the timing of marriage in Kenya. *Demogr Res* 12:1–28
- IPBES (2019) Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. E. S. Brondizio, J. Settele, S. Díaz, and H. T. Ngo (editors). IPBES secretariat, Bonn, Germany, p 1148 <https://doi.org/10.5281/zenodo.3831673>
- Kane S, Kok M, Rial M et al (2016) Social norms and family planning decisions in South Sudan. *BMC Public Health* 16:1183. <https://doi.org/10.1186/s12889-016-3839-6>
- Kebede E, Striessnig E, Goujon A (2021) The relative importance of women’s education on fertility desires in sub-Saharan Africa: a multilevel analysis. *Popul Stud*. <https://doi.org/10.1080/00324728.2021.1892170>
- Kes A, Swaminathan H (2006) Chapter 2: Gender and time poverty in sub-Saharan Africa. In: Blackden CM, Wodon Q (eds) *Gender, time use, and poverty in sub-Saharan Africa*. World Bank Working Paper No. 73, The World Bank, Washington D.C.
- Laurance WF, Sayer J, Cassman KG (2014) Agricultural expansion and its impacts on tropical nature. *Trends Ecol Evol* 29:107–116. <https://doi.org/10.1016/j.tree.2013.12.001>
- Manlosa AO, Hanspach J, Schultner J et al (2019a) Livelihood strategies, capital assets, and food security in rural South-west Ethiopia. *Food Sec* 11:167–181. <https://doi.org/10.1007/s12571-018-00883-x>
- Manlosa AO, Schultner J, Dorresteijn I, Fischer J (2019b) Leverage points for improving gender equality and human well-being in

- a smallholder farming context. *Sustain Sci* 14:529–541. <https://doi.org/10.1007/s11625-018-0636-4>
- Marques A, Martins IS, Kastner T et al (2019) Increasing impacts of land use on biodiversity and carbon sequestration driven by population and economic growth. *Nat Ecol Evol* 3:628–637. <https://doi.org/10.1038/s41559-019-0824-3>
- Martin TC (1995) Women's education and fertility: results from 26 demographic and health surveys. *Stud Fam Plann* 26:187. <https://doi.org/10.2307/2137845>
- Mayring P (2000) Qualitative content analysis. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research* <https://doi.org/10.17169/fqs-1.2.1089>
- McClendon KA, McDougal L, Ayyaluru S et al (2018) Intersections of girl child marriage and family planning beliefs and use: qualitative findings from Ethiopia and India. *Cult Health Sex* 20:799–814. <https://doi.org/10.1080/13691058.2017.1383513>
- Newmarch A, Bekere K (2016) Faith-based forums in Ethiopia: an initiative for development cooperation. In: Ware A, Clarke M (eds) *Development across faith boundaries*. Taylor and Francis, Routledge
- Nyborg K, Anderies JM, Dannenberg A et al (2016) Social norms as solutions. *Science* 354:42–43. <https://doi.org/10.1126/science.aaf8317>
- Olson DJ, Piller A (2013) Ethiopia: an emerging family planning success story. *Stud Fam Plann* 44:445–459. <https://doi.org/10.1111/j.1728-4465.2013.00369.x>
- Omoeva C, Hatch R (2020) Teenaged, married, and out of school: effects of early marriage and childbirth on school exit in Eastern Africa. *Prospects*. <https://doi.org/10.1007/s11125-020-09517-7>
- Pyhälä A, Fernández-Llamazares Á, Lehvävirta H et al (2016) Global environmental change: local perceptions, understandings, and explanations. *Ecol Soc*. <https://doi.org/10.5751/ES-08482-210325>
- Population Reference Bureau 2015. *Early Marriage Trends*. <https://scorecard.prb.org/early-marriage-trends/>. Last accessed 15 Dec 2021
- Robinson WC (1997) The economic theory of fertility over three decades. *Popul Stud* 51:63–74. <https://doi.org/10.1080/0032472031000149736>
- Rodrigues P, Dorresteijn I, Senbeta F, Fischer J (2019) Living on the edge: rapid assessment of the mammal community in a coffee forest in south-western Ethiopia. *Afr J Ecol* 57:279–285. <https://doi.org/10.1111/aje.12588>
- Rodrigues P, Shumi G, Dorresteijn I et al (2018) Coffee management and the conservation of forest bird diversity in southwestern Ethiopia. *Biol Cons* 217:131–139. <https://doi.org/10.1016/j.biocon.2017.10.036>
- Rovin K, Hardee K, Kidanu A (2013) Linking population, fertility, and family planning with adaptation to climate change: perspectives from Ethiopia. *Afr J Reprod Health* 17(3):15–29
- Sahleyesus DT, Beaujot RP, Zakus D (2009) Attitudes toward family size preferences in urban Ethiopia. *J Comp Fam Stud* 40:97–117. <https://doi.org/10.3138/jcfs.40.1.97>
- Sasson I, Weinreb A (2017) Land cover change and fertility in West-Central Africa: rural livelihoods and the vicious circle model. *Popul Environ* 38:345–368. <https://doi.org/10.1007/s11111-017-0279-x>
- Searchinger T, Hanson C, Waite R et al (2013) *Achieving replacement level fertility*. Working paper. Installment 3 of “Creating a Sustainable Food Future”. World Resources Institute
- Shapiro D, Gebreselassie T (2013) Fertility transition in Sub-Saharan Africa: falling and stalling. *APS* <https://doi.org/10.11564/23-1-310>
- Sharan M, Ahmed S, May J, Soucat A (2011) *Family Planning trends in Sub-Saharan Africa: Progress, Prospects, and Lessons Learned*. Yes, Africa Can: Success Stories from A Dynamic Continent. Chapter 25. The International Bank for Reconstruction and Development
- Shreffler KM, Nii-Amoo Doodoo F (2009) The role of intergenerational transfers, land, and education in fertility transition in rural Kenya: the case of Nyeri district. *Popul Environ* 30:75–92. <https://doi.org/10.1007/s11111-009-0077-1>
- Shumi G, Rodrigues P, Schultner J et al (2019) Conservation value of moist evergreen Afromontane forest sites with different management and history in southwestern Ethiopia. *Biol Cons* 232:117–126. <https://doi.org/10.1016/j.biocon.2019.02.008>
- Smith CA, Paulson Stone R, Kahando S (2012) A model of women's educational factors related to delaying girls' marriage. *Int Rev Educ* 58:533–555. <https://doi.org/10.1007/s11159-012-9309-1>
- Taddese G (2001) Land degradation: a challenge to Ethiopia. *Environ Manag* 27(6):815–824. <https://doi.org/10.1007/s002670010190>
- Terefe A, Larson CP (1993) Modern contraception use in Ethiopia: does involving husbands make a difference? *Am J Public Health* 83:1567–1571. <https://doi.org/10.2105/AJPH.83.11.1567>
- United Nations, Department of Economic and Social Affairs, Population Division (2019) *World population prospects 2019*, online edition. Rev. 1. File POP/1–1: Total population (both sexes combined) by region, subregion and country, annually for 1950–2100 (thousands). <https://population.un.org/wpp/Download/Standard/Interpolated/>
- UNDP-EUE (2000). *Ethiopia: Region, zone and wereda population and relief beneficiary data for 1999 and 2000*. Situation Report. Retrieved in <https://reliefweb.int/report/ethiopia/ethiopia-region-zone-and-wereda-population-and-relief-beneficiary-data-1999-and-2000>. Last accessed 15 Dec 2021
- Wodon Q, Male C, Nayihouba A, Onagoruwa A, Savadogo A, Yedan A, Kes A, John N, Steinhaus M, Murithi L, Edmeades J, Petroni S (2018) *Economic impacts of child marriage in Ethiopia: synthesis report*. The World Bank and International Center for Research on Women, Washington, DC
- World Bank Data (2019) Fertility rate, total (births per woman) - Sub-Saharan Africa, South Asia, Latin America & Caribbean. <https://data.worldbank.org/indicator/SP.DYN.TFRT.IN?locations=ZG-ZJ-8S> Last accessed 17 Dec 2021
- World Bank Data (2020) Rural population (% of total population) – Ethiopia. <https://data.worldbank.org/indicator/SP.RUR.TOTL.ZS?locations=ET> Last accessed 15 Dec 2021

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