

**Population Growth and Family Planning in the Nationally
Determined Contributions (NDCs) made under
the Paris Climate Agreement**

Working paper

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Abstract

Under the Paris Agreement, nations made pledges known as nationally determined contributions (NDCs): national climate plans detailing countries' ambitions to adapt to climate change and reduce greenhouse gas emissions. Population growth is a driver of both climate vulnerability and climate-altering emissions. We asked, to what extent do countries take population growth into account in their NDCs, beyond simple statements of population trends? Our research method was a comprehensive text review of 164 NDCs submitted by governments. About one-third (49) of countries' NDCs either link population growth to a negative effect and/or identify population growth as a challenge or trend affecting societal needs. These countries had a significantly higher population growth rate and unmet need for family planning than those with no attention to population growth. Common impacts of population growth were increased energy demand, natural resource degradation, vulnerability to climate impacts and decreased food and water security. Seven NDCs included strategies to slow population growth, but specified no implementation measures. Overall, the adaptation potential and mitigation co-benefits associated with meeting the unmet need for family planning are largely overlooked in national NDC documents, suggesting that they are also neglected in countries' climate change planning. In upcoming rounds of NDC updates, we recommend that governments consider the potential impact of population growth on mitigation and adaptation efforts, prioritize meeting their unmet needs for family planning, and integrate population-health-environment projects in their national climate plans.

Keywords: NDC, population growth, climate vulnerability, family planning, adaptation

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1. Introduction

Prior to the adoption of the Paris Agreement in 2015, nearly all countries submitted intended nationally determined contributions (INDCs) indicating their strategies for climate action. These INDCs became nationally determined contributions (NDCs) once the Paris Agreement came into force in 2016, and describe countries' ambitions to reduce emissions and adapt to climate impacts given their national circumstances (Bodansky 2016). NDCs differ from previous United Nations Framework for the Convention on Climate Change (UNFCCC) submissions as they apply to all countries and include strategies to prepare for climate impacts (the adaptation component) and strategies to reduce emissions (the mitigation component). Thus, the NDCs provide an opportunity to investigate climate priorities for nearly all governments in an international forum. So far, NDCs have been reviewed to determine how governments address issues related to oceans (Gallo et al. 2017), REDD + (Hein et al. 2018; Gallo and Albrecht 2019), land use, land use change and forestry (Fyson and Jeffery 2019) and waste management (Powell et al. 2018). However, no scholarly review to date has analyzed NDC's treatment of population growth or family planning policies—a glaring oversight, given the important roles they could play in undermining or helping to achieve nations' adaptation and mitigation goals (Ripple et al. 2019, Bongaarts and O'Neill 2018, Hawken 2018, Mogelgaard 2018, O'Sullivan 2018).

There has been one previous population review of a UNFCCC submission. In 2010, Hardee and Mutunga reviewed countries' National Adaptation Programs of Action (NAPAs), national plans submitted by least developed countries to identify immediate adaptation priorities. They found that many countries recognized population growth as a problem that exacerbates vulnerability or reduces resilience; however, few NAPAs identified slowing population growth or investments in family planning as priority adaptation actions (Hardee and Mutunga 2010). The authors recommended that population be included in longer-term adaptation strategies, through attention to family planning and socially beneficial actions such as improving girls' education (Hardee and Mutunga 2010). As NDCs document countries' longer-term adaptation and mitigation strategies, they provide a new opportunity to examine governments' attention to population, for countries of all development levels.

Population growth is directly related to climate adaptation and mitigation as it is a driver of both climate risks (Jones et al. 2015; Liu et al. 2017; Asefi-Najafabady et al. 2018) and climate altering emissions (IPCC 2014a). According to recent projections, the global population

may increase 40% by 2100, from the current 7.7 billion to 10.9 billion (United Nations 2019a). The entirety of this increase is forecasted for less developed regions, considered most vulnerable to climate risks (Jiang and Hardee 2011). Particularly in high impact areas, population growth is likely to exacerbate vulnerability by outpacing investments in social services and increasing the demand and depletion of limited resources (Stephenson et al. 2010). Slowing this growth could help countries increase their capacity to adapt to climate impacts (De Souza 2014) and provide mitigation co-benefits (Engelman 2014).

Many strategies can lead to lower fertility and slower population growth, while accelerating societal development: most notably, family planning programs, girls' education, and programs to promote gender equity (Bongaarts 2016). Family planning is becoming increasingly recognized as a human-rights based and cost-effective measure to improve public health and reduce vulnerability to climate risks (Hardee et al. 2018; Mogelgaard 2018), particularly as over 214 million women of reproductive age want to stop or delay childbearing but are not using modern contraception (Starrs et al. 2018). Meeting this need could improve maternal and child health (Chola et al. 2015), and ease future population pressure on food and water security (Moreland and Smith 2012; Gunasekara et al. 2013), enhancing societal resilience to climate impacts.

Here we ask, to what extent do countries take population growth into account in their NDCs, beyond simple statements of population trends? We answer this research question through a text review of 164 NDCs submitted by governments. Countries' concerns related to population growth, and any proposed actions or strategies to slow population growth, are identified. Our more specific questions are:

- 1) Which countries explicitly included impacts of population growth in their NDCs?
- 2) What are the most common impacts they identified?
- 3) Does population growth rate or the unmet need for family planning differ between countries that recognized impacts of population growth and those that did not?
- 4) What actions or strategies, if any, were proposed to slow population growth?

Overall, we expect countries that include impacts of population growth in their NDCs to have higher population growth rates and a higher unmet need for family planning. We also

expect countries that include impacts of population growth to outline actions or strategies to slow population growth. We acknowledge the importance of other population variables, including e.g. urbanization, migration, population density and ageing, but an NDC review of all population variables was beyond the scope of our study. Here we limit our review of NDCs to population increase; hence in what follows, ‘population’ refers to changes in population size. The key knowledge gaps that we explore are the degree to which governments included impacts of population growth in their NDCs, and what adaptation or mitigation strategies they outlined to address population concerns.

2. Methods

We reviewed 164 of 166 NDCs submitted to the UNFCCC Secretariat by August 2018. This covers 191 countries and associated territories, since the NDC from the European Union spans all 28 EU members (see Online Resource 1 for full list of parties). France submitted a complementary NDC for its associated territories. This complement was an addendum to the EU NDC and is included in the NDC count as part of the EU NDC. However, both the EU NDC and addendum are excluded from analysis due to differences in data scale (i.e. values for the EU are regional averages, while all other data points are country-level), and due to lack of data for the territories included in the addendum. If a party submitted a revision, we analyzed the most recent submission.

We selected two core ‘population’ keywords and completed a standardized search for these keywords in each NDC (see Table 1). We identified paragraphs of text with core keywords, and identified secondary keywords indicating increases in population size, henceforth referred to as growth keywords (e.g. grow, increase, expand; see list of growth keywords in Table 1). When core keywords were found in combination with growth keywords, the entire section was extracted and read in its entirety.

When we found no core keywords, or core keywords were not found in combination with growth keywords, we classified the NDC as population exclusive. Similarly, if population growth was mentioned but the impacts of growth were not included (e.g. “the current population growth rate is xx%”) or it was stated as a methodological assumption (e.g. “the baseline scenario is based on the following population projections”), the NDC was also classified as population exclusive. This is because NDC guidance documents encouraged countries to state population

trends when describing their level of ambition (Holdaway and Dodwell 2015), and include population assumptions in their emission projection methodologies (Levin et al. 2015) (see Online Resource 2). Only when countries clearly stated the impacts of population growth, identified population growth as a challenge, or identified population growth as a trend affecting societal needs, did we classify the NDC as population inclusive (see Table 2 for examples). This approach ensured the identification of NDCs that explicitly included impacts of population increase.

We counted and categorized the impacts of population growth. Ten categories were used, based on the categories used in a previous review of countries' NAPAs (Hardee and Mutunga 2010). Impacts were counted in two ways: the absolute number of NDCs that included each impact (number of NDCs) and the total number of times each impact was identified within and among NDCs (frequency).

Most NDCs were submitted in English (118) or had English translations available (25). Those that did not have an English translation available (Spanish (8), French (13)), were reviewed using Google translate. We excluded two NDCs submitted in Arabic with no translation (Iraq and Kuwait). For non-English NDCs, we translated core keywords into the respective language and conducted a standardized search for the core keywords in the NDC. We translated any identified paragraphs to English to determine the presence or absence of growth keywords (see Table 1 for non-English keywords). When we found core keywords in combination with growth keywords, we translated the entire section to English, then read and evaluated it following the same protocol.

Table 1. Core search keywords and identified growth keywords. Bold growth keywords indicate keywords in NDCs that included at least one impact of population growth. Asterisks indicate the truncation operator used in the search.

Language	Core keywords	Growth keywords
English	populat*, demograph*	grow*, increas*, project*, expansion, surge, stabiliz*, dynamics, control, forecast, trend*, will be, expected to/will reach, change*
Spanish	poblac*, demográf*	crecimiento, proyecciones, aumento
French	populat*, démograph*	croiss*, changements, evolution, augmenté, projections

Although NDCs varied considerably in length and content, they followed a similar format: an introductory section including national circumstances, a mitigation section, and an optional adaptation section. Mitigation refers to actions that result in reductions of national greenhouse gas (GHG) emissions. Adaptation refers to vulnerabilities from climate change and actions that reduce climate change impacts. Every time an impact of population growth was identified, the corresponding section was noted. If the section heading was unclear, we used section content to determine whether the impact was discussed in terms of national circumstances, mitigation or adaptation.

Table 2. Selected excerpts from NDCs classified as population inclusive.

Party	NDC excerpt
United Arab Emirates	“The UAE’s population has more than tripled since 1995, and will continue to grow, putting increased pressure on the supply of energy and water.”
Indonesia	“As the Indonesian population grows, climate change-induced natural disasters will affect a greater number of people and their assets, making it difficult for them to escape poverty.”
Azerbaijan	“The increase of the population of Azerbaijan by approximately 1.1% or 100 thousand people per year projected in the official national statistics will increase the demand for energy and other natural resources. This represents one of the main challenges for the reduction of GHG emissions.”
Haiti	“However, the measures [to increase the country's resilience and reduce vulnerability] have not the scale and intensity needed to meet the needs arising from the changes taking place, particularly in terms of demography and ecosystems.”
Guinea	"Nevertheless, against a background of strong demographic growth (with the population doubling every 25 years), there is an urgent need to speed up and diversify economic growth to meet the present social challenges whilst not placing undue constraints on future generations."
Togo	“With an average annual growth rate of 2.84%, the country can expect to reach 7,121,673 inhabitants in 2015, 60% of whom under the age of 25. As a result, Togo will need to meet the challenge of providing decent jobs to that population, once it hits the labor market.”

Population growth data originate from the United Nations World Population Prospects (United Nations 2019a). We obtained data for the unmet need for family planning from the

United Nations Estimates and Projections of Family Planning Indicators (United Nations 2019b). The unmet need for family planning is defined as the percentage of women of reproductive age (15-49 years) who want to stop or delay childbearing but are not using contraception.

We used a t-test to analyze the difference in population growth rates for countries with population inclusive NDCs ($n=48$) and those that did not include impacts of population growth in their NDCs ($n=115$). Since data for the unmet need for family planning were not normally distributed within groups, we used a Mann-Whitney test to analyze differences in the unmet need for family planning between groups (samples of $n=42$ and $n=103$), excluding 18 countries due to lack of data (Cook Islands, Iceland, Liechtenstein, Marshall Islands, Micronesia, Monaco, Nauru, Palau, South Sudan, St. Kitts and Nevis, Tuvalu, West Bank and Gaza (Palestine), Andorra, Brunei, Dominica, Niue, San Marino and Seychelles). We present mean \pm standard error.

3. Results

3.1 Countries including impacts of population growth in NDCs

Of the 164 climate plans collectively submitted by 191 countries, 49 countries identified at least one impact of population growth in their NDC (Fig. 1). The large majority of these population inclusive NDCs were submitted by countries in less developed regions (94%); almost half were submitted by countries in Africa (49%), followed by Asia (16%) (Fig. 1). Only 3 countries from more developed regions included population effects in their NDCs, all in Europe: Andorra, San Marino and Switzerland (Fig 1).

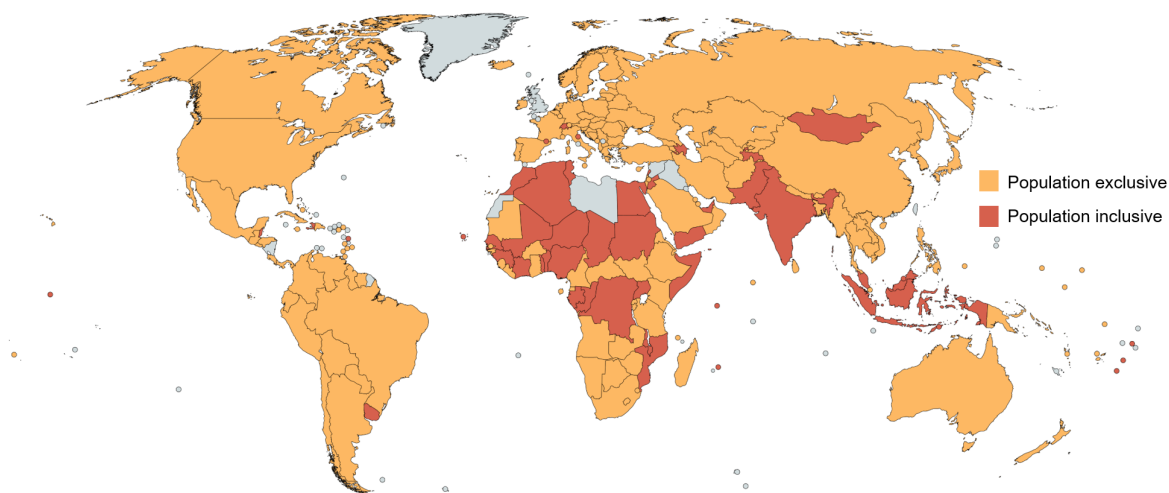


Fig 1. Map of countries and microstates that refer to impacts of population growth in their NDCs. Orange indicates countries that did not include impacts of population growth in their NDC (population exclusive), while red indicates countries that included at least one impact of population growth in their NDC (population inclusive). Gray indicates countries that either did not submit NDCs by the time of review or were excluded (Iraq and Kuwait). Saint-Barthelemy, a French territory that submitted a population inclusive NDC as an addendum to the EU NDC, is not shown on this map.

3.2 Common impacts of population growth

The most common impacts of population growth identified by governments were related to energy use and security, natural resource degradation and demand, vulnerability and resilience, agricultural expansion and food security, and water security (Fig. 2, see Table 3 for a list of countries by the ten categories). Impacts were most frequently included in the national circumstance component and least frequently in the mitigation component (Fig. 2). For five of the ten categories, impacts were most frequently included in countries' national circumstances. Climate vulnerability and resilience and water security were most frequently associated with adaptation, while agriculture and food security, GHG emissions and land use change were most frequently associated with mitigation. Impacts in agriculture and food security had the broadest connections across all three components: national circumstances, mitigation, and adaptation (Fig 2).

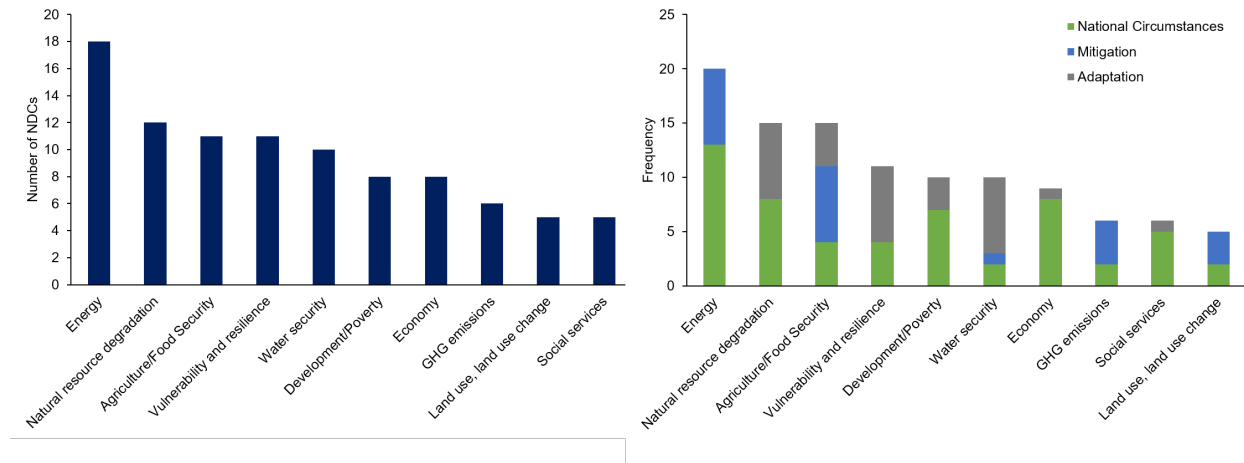


Fig. 2 Impacts of population growth identified in NDCs ($n=93$) (left). Frequency of inclusion, disaggregated by NDC component (national circumstances, mitigation or adaptation) ($n=107$) (right).

The most commonly identified impacts of population growth were energy use and security (18 NDCs), identified most often as a national circumstance (Fig. 2). In general, governments were concerned about increases in energy production and consumption due to population increase. Specific energy concerns related to population growth were increases in road traffic volume and/or building heating, as noted in NDC submissions from Switzerland, Lebanon, Brunei and Andorra. Eight of the eighteen parties that linked population growth to energy concerns (Belize, Benin, Indonesia, Jordan, Niger, Pakistan, Tajikistan, Timor-Leste) have very low per capita energy use, below 1000 kg oil equivalent per year (IEA 2014), and population growth rates above the global average (United Nations 2019a).

Table 3. Population inclusive NDCs by category.

Category	Countries
Energy	Algeria, Andorra, Azerbaijan, Belize, Benin, Brunei, Saint-Barthelemy Island, Guinea, Indonesia, Jordan, Lebanon, Niger, Pakistan, San Marino, Switzerland, Tajikistan, Timor Leste, United Arab Emirates
Natural resource degradation and/or demand	Azerbaijan, Belize, Egypt, Indonesia, Jordan, Kiribati, Lebanon, Malawi, Mali, Somalia, Tonga, Yemen
Vulnerability and resilience	Algeria, Chad, Dominica, Haiti, Kiribati, Mali, Mauritius, Mongolia, Seychelles, Sudan, Yemen
Agriculture/food security	Republic of Congo, Gabon, Guinea, India, Indonesia, Kiribati, Niger, Nigeria, Pakistan, Timor Leste, Uruguay
Water security	Indonesia, Jordan, Kiribati, Lebanon, Malaysia, Morocco, Seychelles, Sudan, Togo, United Arab Emirates
Development and/or poverty	Algeria, Guinea, Indonesia, Lebanon, Mozambique, Senegal, Timor Leste, Uganda
Economy	Algeria, Democratic Republic of Congo, Egypt, Guinea, Lebanon, Pakistan, Togo, Yemen
GHG emissions	Cote D'Ivoire, Guinea, Jordan, Niger, Nigeria, Samoa
Land use, land use change	Cabo Verde, Guinea, Lebanon, Niue, Tunisia
Social services	Algeria, Democratic Republic of Congo, Egypt, Lebanon, Yemen

Increases in population were also associated with food insecurities and emission increases due to rising food demand (11 NDCs). Some countries, like Kiribati, expressed adaptation concerns that food production systems may not meet the needs of an increasing population. However, concerns about rising food demand were more frequently related to mitigation (Fig. 2). Many governments were concerned about the likely increase in agricultural emissions to meet future food needs. The NDC submitted by United Arab Emirates, an import dependent country, stated that food imports are expected to double with continuing population growth.

Eleven countries recognized population growth as a factor increasing climate vulnerability and affecting resilience, primarily in the adaptation component (Fig. 2). Seychelles' and Mauritius' NDCs noted that population increase will have an “additional climate-health related burden.” The NDC submitted by Mongolia identified its growing population as one factor rendering Mongolia's socio-economic development vulnerable to climate change. Haiti, a country with an annual population growth rate of 1.3%, has taken measures to reduce vulnerability, but states that the measures have not had the scale or intensity to meet the needs arising from demographic growth.

In ten NDCs, governments linked population growth to water security concerns (Fig. 2). Many countries acknowledge that population growth has increased the demand for freshwater, and express adaptation concerns for future water security. In Malaysia's NDC, high population growth was identified as a factor leading to water-stress; in Sudan's NDC population growth was identified as one of four factors that make a “looming water crisis appear likely.” Three of the ten countries—Sudan, Jordan and the United Arab Emirates—already have water stress levels over 100% (FAO 2016) and population growth rates of 2.4%, 1.9% and 1.3% respectively (United Nations 2019a). At a population growth rate of 2%, a country doubles its population in 35 years.

3.3 Population growth rate and unmet need for family planning

The countries that included impacts of population growth in their NDCs had higher population growth rates ($n=48$, mean= 1.78 ± 0.14) than countries that did not ($n=115$, mean= 1.30 ± 0.10) ($t=2.72$, $df=161$, $p=0.007$, Fig. 3). The unmet need for family planning also differed: countries with population inclusive NDCs ($n=42$, median=15.3%) had a higher unmet need for family planning than countries that submitted population exclusive NDCs ($n=103$, median=10.6%) ($U=2850$, $p=0.003$, Fig. 3).

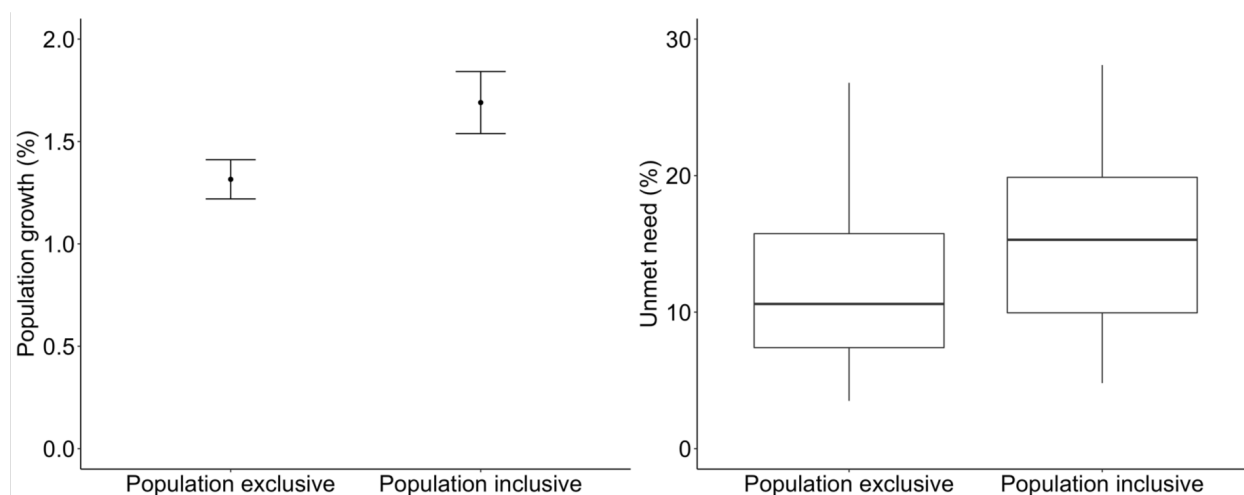


Fig. 3 Countries that included impacts of population growth in their NDCs (population inclusive) had significantly higher population growth rates (left) and higher unmet need for family planning (right) than countries that did not include these impacts (population exclusive).

3.4 Actions and strategies to slow population growth

Of the 49-population inclusive NDCs, only 7 included an action or strategy to slow population growth (Fig. 4). These actions or strategies were primarily adaptation measures, national development priorities, or means of NDC implementation. Tunisia was the only country to include a population related measure as a mitigation action (Table 4).

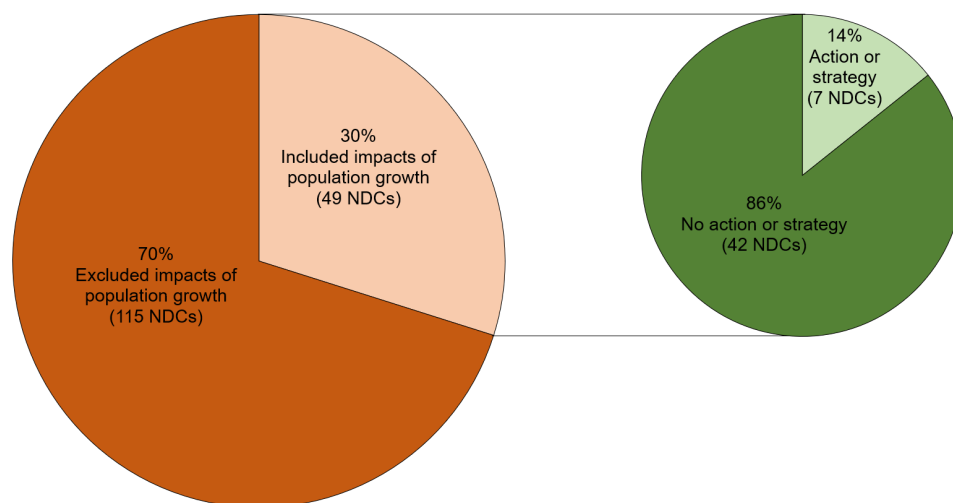


Fig. 4 Proportion of NDCs that included actions or strategies to slow population growth. Of 164 NDCs (left), just under one-third included at least one impact of population growth. However, recognizing the climate-related impacts of population growth largely did not transfer into actions or strategies to slow population growth: only 7 NDCs included an action or strategy to slow population growth (right).

Only 2 of the 7 NDCs (Mauritius and Uganda) included strategies to slow population growth. The other 5 parties described ambiguous population efforts or included a population goal but provided no implementation measures (Table 4). Mali and Togo integrated national development goals and climate strategies to develop very broad population actions. For example, Mali integrated its Strategic Framework for Growth and Reduction of Poverty and national adaptation policies to create a list of adaptation actions, one of which was, “Master and manage the evolution of the population of Mali.” Niger was the only country to include a specific population growth rate target (Table 4), referencing the Niger Sustainable Development and Inclusive Growth Strategy 2012-2035.

Table 4. List of actions and strategies identified by parties to address concerns related to population growth.

Country	Section	Sub-section	Action or strategy
Mali	Adaptation	National Policies and Strategies	“Master and manage the evolution of the population of Mali”
Mauritius	Adaptation	Adaptation Measures, Health Sector	“Mainstream climate change adaptation in the health sector to respond to population increase and its additional climate-related health burdens”
Egypt	National Circumstances	National Objectives and Priorities	“Focus efforts on controlling population growth”
Togo	National Circumstances	Commitment to Sustainable Development	“Efforts focused on lack of population control”
Niger	Means of Implementation	Obstacles and Gaps	“Reduce the population growth rate from 3.9% to 2.35% in the 2035 horizon”
Uganda	Means of implementation		“Provide adequate support for policies and programs that take into account the interactions between population dynamics, climate change and development”
Tunisia	Mitigation	Sustainable Development Impacts, Forestry and Other Land Usages Sector	“Population stabilization and prevention of rural depopulation”

4. Discussion

The research question posed, to what extent do countries take population growth into account in their NDCs (beyond simple statements of population trends) can be answered and summarized as follows. The majority of parties to the Paris Agreement did not include explicit impacts of population growth in their NDCs outside of population trends and emission projection assumptions. The minority of parties that did recognize impacts of population growth did so in regards to their ability to limit emissions, cope with climate impacts, and/or meet societal needs. As hypothesized, governments that included population concerns in their NDCs had significantly higher population growth rates and a higher unmet need for family planning than those that did not. Unexpectedly, few parties that recognized the impacts of population growth outlined strategies to slow population growth, and none described detailed implementation measures.

Governments concerned with impacts of population growth on national climate mitigation and adaptation efforts should identify human rights-based actions to slow population growth, one of which could be to meet the unmet need for family planning.

In the majority of population inclusive NDCs, population growth was regarded as a factor not amenable to policies. This is demonstrated by the frequent inclusion of population effects in countries' national circumstances (Fig. 2). Mitigation components included the fewest impacts of population growth (Fig. 2), perhaps because slowing population growth is not typically considered to be a mitigation strategy (Newman et al. 2014). Only one country included a population-related mitigation strategy, as a measure to limit emissions in the land use sector (Table 4). Governments seem more willing to link population growth and mitigation in regard to agricultural or land use change emissions (Fig. 2). Perhaps this is to be expected as population growth is one of the most influential determinants for future land use change (Stehfest et al. 2019). Population growth will also greatly influence future emissions from energy use (O'Neill et al. 2010). Parties recognize this relationship, as energy use was the most commonly recognized impact of population growth (Fig. 2); however, slowing population growth is not included as a strategy to reduce energy demand in any NDCs.

Population growth seems to be of particular adaptation concern for countries in regard to future water security, natural resource degradation, and vulnerability and resilience to climate impacts (Fig. 2). This linkage between population growth and future water security is not surprising; depending on the study scale, future water scarcity is driven primarily by population increase, and secondarily by climate change (Schewe et al. 2014; Smirnov et al. 2016). In addition, countries projected to be most impacted by climate change have a large proportion of their populations dependent on climate sensitive sectors for their livelihoods (Bathiany et al. 2018). This seems to be reflected in countries' concerns about the impact of population growth on natural resources. It is well established that population growth increases vulnerability to climate impacts (Rovin et al. 2013; IPCC 2014b; Hardee et al. 2018) and can also hinder adaptation measures, as noted in Haiti's NDC. Despite frequent population-related adaptation concerns across many NDCs, only two strategies to address population growth were included as adaptation measures (Table 4).

Overall, recognizing the impacts of population growth on climate-related issues has yet to lead to specific strategies to slow population growth. These results are similar to a previous

review of least developed countries' NAPAs. In their review, Hardee and Mutunga (2010) found that 37 of the 41 NAPAs recognized population pressure as an issue related to the ability to cope with climate change. Of those, six clearly stated that slowing population growth should be among the country's priority adaptation actions but only two detailed implementation measures. In our review, only seven NDCs clearly stated that slowing population growth should be among the countries' mitigation or adaptation actions, but none detailed implementation measures. It is critically important that governments state specific implementation measures in strategies to slow or stabilize population growth, particularly because population objectives should not be obtained by compromising human rights.

The NDCs from Kiribati and Solomon Islands identified poor family planning services and lack of contraceptive use as two factors contributing to high population growth. Despite this recognition and Kiribati's concerns about continued population growth, no strategies were identified to improve family planning services. This should be remedied. Integrated, community-based programs that promote gender equity, ensure access to comprehensive family planning and allow women to have control over their reproductive decisions would increase contraceptive use (Ross and Stover 2013), and in turn increase resilience by reducing future population pressure on climate-sensitive resources (Zlotnik 2009; Guillebaud 2016).

Moreover, family planning has been recognized by local communities (Rovin et al. 2013), nongovernmental organizations (Mogelgaard 2018), and the Intergovernmental Panel on Climate Change (IPCC 2014b) as an action that would improve child and maternal health and simultaneously reduce emissions. In large part due to the multisectoral benefits of family planning, there is a cross-sectoral effort to integrate sexual and reproductive health, population and environment (Newman et al. 2014), reflected in the recent development of Population-Health-Environment (PHE) projects. These projects can be extended to climate change to foster climate resilience communities, as in the recent Population, Health, and Environment and Climate Change project implemented by PATH Foundation Philippines (Women And Gender Constituency 2017). This project applied a PHE approach, utilized multisectoral collaborations and partnerships, and employed multiple interventions to address family planning needs, biodiversity loss, poor health and food insecurity to increase community resilience.

5. Conclusions and recommendations

Overall, a minority of NDCs identified population growth as influencing a country's ability to limit emissions and prepare for climate impacts. Furthermore, no NDC's discussed family planning in a detailed or robust way, despite its clear importance to future mitigation and adaptation. The few NDCs that included strategies to address population growth did so in an ambiguous manner. The Paris agreement is the key international framework for addressing global climate change, and the NDC's are an important part of national planning under this framework. Their failure to adequately address population matters could counteract measures of progress that limit dangerous climate change.

It is crucial that strategies to slow population growth be specific, and include implementation measures that respect human rights. As family planning is increasingly recognized as a cost-effective strategy eligible for adaptation funding, governments concerned with population growth should include family planning in broader, multisectoral climate strategies and projects. Integrated approaches that include population, health and environment should be extended, to prepare for climate impacts and reduce climate risks. As parties begin the next round of NDC updates, they should include Population, Health, Environment and Climate Change projects and other community-based measures that increase resilience and also slow population growth. Finally, scientists and policy experts working on climate change need to include detailed analyses of family planning policies in their future work, in order to encourage politicians to implement necessary policy changes.

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