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Climate Change and Population

AN ANNOTATED BIBLIOGRAPHY

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Table of Contents

Table of Contents

Introduction

In the following pages we provide an overview of 25 research papers that represent some of the diversity of research, perspectives, policy relevance, and advocacy opportunities around population and climate change interactions.

The papers highlighted here emerge from conferences, books and academic journals from the past 10 years. In particular we paid attention to work coming out of UN agencies and from academic and research institutions that have presented papers at research meetings such of the Population Association of America, the Asian Population Association, the International Union for the Scientific Study of Population, and the Union for African Population Studies. We searched two academic databases, Pub Med, and Scopus. After locating several hundred papers from preliminary searches with narrowed parameters, a team reviewed the results to reduce overlap of topics, authors and geographic scope.

We selected these final 25 papers as a useful start to anyone interested in exploring how the issues of population dynamics, reproductive health, family planning, women's empowerment and climate change interact. Undoubtedly, the selection of these papers reflects some of our biases. Population Action International is primarily interested in policy application, climate change adaptation, and the role of increasing access to family planning and reproductive health services as a way to improve the well-being of women, their families and the environment.

This annotated bibliography was produced by the research department at Population Action International. The primary author is Bernice Kuang, a research intern, with contributions from Roger-Mark De Souza and Clive Mutunga.

This bibliography was made possible by financial support from PAI's Climate Change Initiative. The Initiative is a multi-year program of research, advocacy and strategic communications. The Initiative is designed to bring PAI's decade-long expertise of looking at the connections of population, reproductive health, security, and the environment to the attention of advocates and policymakers. This work strengthens the understanding of the influence of population on climate change vulnerability, and expands the concept of climate change resilience by highlighting critical gender, fertility, and reproductive health dimensions.

For more information, please visit **http://populationaction.org/topics/climate-change/**

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Exploring the Connections

1) O'Neill, B., Dalton, M., Fuchs, R., Jiang, L., Pachauri, S., Zigova, K. 2010. "Global Demographic Trends and Future Carbon Emissions." Proceedings of the National Academies of Science. 107(41): 17521-17526.

Earlier studies have oversimplified the role of population in emissions, using simple multiplicative models that do not account for relationships between population, economics, and technology. This study uses survey data from 34 countries, covering 61% of the global population, for economic characteristics to calibrate the PET model (Population Environment Technology Model) with parameters like demand, labor supply, wealth, and projects population for several scenarios. PET accounts for the indirect relationships between age structure and labor supply, population growth and economic growth, urbanization and labor productivity, demographic change on savings/spending behavior. It also considers the reality that the population will be aging in some places, and household sizes will decline (trending toward nuclear families and away from multigenerational households). Aging and urbanization are also found to impact emissions in certain places in the world. Overall, results suggest that slowing population growth could lead to 16-29% of the desired carbon emissions reduction deemed necessary by 2050 to prevent dangerous climate change. Moreover, aging can reduce emissions by up to 20% in industrialized places, through lowered labor productivity, older labor forces and slower economic growth. Urbanization in less developed areas could lead to 25% increase in projected emissions, for the same, but converse, reasons. The authors conclude that FP policies that meet unmet need could lead to the low variant population projections scenarios referenced in the paper, realizing a decline of 0.2 births per US woman, and a 0.6-0.7 births per developing country woman.

2) Skeer, J. 2002. "Links Between Cairo and Kyoto: Addressing Global Warming Through Voluntary Family Planning." *Ambio.* 31(1): 28-9.

Given the link between family planning and slower population growth, and the link between population and carbon emissions, this paper asserts that extending voluntary family planning could contribute to the greenhouse gas (GHG) limitation goals outlined in the Kyoto Protocol (37 industrialized countries' and European community's commitment in 1997 to reduce GHG emissions). FP helps facilitate fertility decline, as evidenced by the proportion of developing country women using modern birth control rising from 9% (1960-65) to 55% (1993), and the subsequent developing country TFR going from 6.1 to 3.3 in approximately the same time. During the International Conference on Family Planning and Development in Cairo (1994), it was agreed to increase FP funding incrementally over the years. The rationale behind this was that since many women have an unmet need for family planning, meaning they desire it but cannot afford it or do not find it readily accessible, a decline in fertility can be achieved by voluntary means. Particularly, it is estimated that a 14% increase in CPR leads to one less child per woman. Following Cairo's plan to extend family planning funding, this would put the population peak at 7.7 billion in 2050, on target for the low variant UN projection. The formula for how this figures into carbon emissions aversion is described in three steps: Step 1 - Annual country per capita emission is multiplied by country life expectancy (accounting for 20 years of discounted emissions, for years lived when you are very old or very young) (X); Step 2 - X is weighted according to the share of FP country x would receive if Cairo were fully funded; and Step 3 - Xs are summed to obtain total weighted emissions. Given 10 t GHG per lifetime, Cairo commitment to family planning could help to avert 10 billion tonnes of GHG in 2050. FP expenditure to prevent 1 unintended birth ($105 USD), divided by 10 t of GHG per lifetime, yields $10.5 per averted tonne, much more cost effective than many other methods. This estimate may overstate the impact of averting a birth because public FP programs might affect poor people more, who may emit less than the average person; or, a reduced population could increase the consumptive capacity of the remaining population. It may understate the impact because in the future, these countries may improve economically and emit more than what is currently estimated (so GHG averted per birth might currently be biased low), and also, this doesn't take into account deforestation (a ramification of population growth), which also exacerbates atmospheric GHG.

3) Rybski, D., Kropp, J.P., Costa, L. 2011. "A Human Development Framework for CO_2 Reductions." *PLoS One.* 6(12).

Although developing countries should participate in the climate change response, they still need to be able to

develop appropriately in order to reduce poverty and improve human well-being. Even so, the CO_2 needed for development of 104 developing countries is less than their "budgeted amount" in the proposed scheme. In this paper, the authors demonstrate that there is a positive and time dependent correlation between development (as measured by the Human Development Index, HDI) and per capita CO_2 emissions from fossil fuel combustion. With this concept, they predict the HDI under three population scenarios, and they calculate the cumulative CO_2 emissions necessary for developing countries to get to that HDI. (Assessed following a Development As Usual (DAU) approach.) By 2050, around 85% of the world's population will live in countries with high HDI (above 0.8). Particularly, 300 Gt of cumulative CO_2 emissions are estimated to be necessary for the development of 104 developing countries between 2000 and 2050. This value is only 20-30% of the previously calculated carbon emissions budget targets for limiting global temperature increase to below 2 degrees Celsius. Thus, this way, there is a path for developing countries to proceed with development and improve their standard of living, while still staying on target to keep climate change below 2 degrees Celsius.

4) Wheeler, D., Hammer, D. 2010. "The Economics of Population Policy for Carbon Emissions Reduction in Developing Countries." Center for Global Development Working Paper 229. Washington, DC: Center for Global Development.

This paper estimates the cost of carbon emissions aversion through family planning and female education policies and finds that it is more cost effective than technical solutions (such as carbon efficiency, low carbon energy, forestry/agriculture). Female education also is demonstrably helpful as an adaptation strategy. Calculations assume that marginal abatement from an avoided birth (marginal intensity) is the same as average emissions intensity. The authors use methods that tend to be conservative to test robustness (e.g., calculated marginal intensity as 25% of estimated average, to quadruple abatement cost; also, multiplied FP costs by 10) and bias estimate of relationship downward. The cost turns out to be $4.50/ton of averted carbon emissions for family planning spending and $10.00/ton for female education. At a country level, 40 out of 88 developing countries have FP costs below the forestry agriculture option (set at a $5/ton averted standard), 70 have costs below low carbon energy (set at a standard of $20/ton averted). The combined effect of spending on schooling and family planning shows that the optimal allocation schedule is 65% for schooling, 35% to family planning, because as education increases, the cost per birth averted decreases, making family planning more cost "efficient." Using econometric analysis, expanding education at a faster rate than current projections would also help weather-related (e.g., drought, flood) morbidities and mortalities. The current level of investment in FP is deemed insufficient and additional financial support is necessary or millions of women will remain unserved.

5) Wire, T. 2009. "Fewer Emitters, Lower Emissions, Less Cost: Reducing Future Carbon Emissions by Investing in Family Planning." London: London School of Economics.

The UNFPA says that meeting all unmet family planning need around the world reduces unintended births by 72% and the PRB says 200 million women have unmet need. Many studies have looked at the costs and benefits of family planning, but fewer have examined it in the context of carbon emissions, especially in a cost/benefit analysis. This study looks at the mitigation potential of family planning, calculating the scale of reduction possible for a given price, expressed as price per unit of emissions averted. The causal mechanism proposed is that further spending on FP will increase awareness of FP and reduce birth rates and population growth rates. With a reduced future population, CO_2 emissions also will be reduced. Wire explains the rationale behind methods and calculations and concludes that family planning programs would reduce emissions by 34 Gt due to decreased number of lived person years. Given the cost for FP reported by UNFPA and UNFPA's assumption that meeting unmet need reduces unintended pregnancy by 72%, and UNSD's estimated carbon emissions per capita, Wire also finds that FP is more cost effective than nearly every other technology-related strategy (wind, solar, hybrids, electric vehicles) at $7 per tonne of CO_2 averted, versus $13-$131. Taking into account limitations of scale (feasible total), tech programs are 5 times more expensive than FP. Specifically, 34 Gt reduction of CO_2 costs over $1 trillion with low carbon tech, whereas with basic FP, it costs $220 billion. Thus, family planning is a cost effective strategy for reducing carbon emissions.

Climate Change Vulnerability

6) Alber, G. 2009. "Gender and Climate Change Policy." In Guzman, J., Martine, G. McGranahan, G., Schensul, D., Tacoli, C. (Eds.). *Population Dynamics and Climate Change.* New York: UNFPA, pp. 146-163.

Systemic cultural patterns and social roles put women at increased vulnerability to the impacts of climate change in the developing world. For example, in rural India, women spend more time doing unpaid work than men, at an estimated 36 hours a week, versus 3.5 hours a week for men. Much of this unpaid work is centered around gathering natural resources, such as fuel and water, which will be stressed by climate change and further expand the time spent on unpaid work by women, to the detriment of paid work and education. Other economic vulnerabilities (i.e., the gender pay gap; fewer economic opportunities; the asset gap, including land, less access to markets and credit, stocks, bonds, savings) will be exacerbated with rising food prices and other climate-related changes. Women also care for the sick and the elderly, which might become a bigger task with greater climate variability during times of stress, such as evacuations and living in refugee camps.

Women also are less represented at the decision making level in governments, corporations, and UN climate sessions. Because of this, climate- related disaster responses, such as flood warnings, do not account for women's needs. For example, in Bangladesh, because women do not frequent public spaces like men do, they often do not hear or understand flood warnings and do not evacuate without a male escort. During and after disasters, women are exposed to sexual harassment/violence in refugee camps and shelters, and their basic reproductive health needs (menstruation, sanitation, post-partum nutrition) are overlooked. There also is evidence of higher fatalities during flood/heat waves for women, with the highest mortality among elderly women and, thus, also a bigger depression on life expectancy. Women consume less due to their lower incomes but also are more vulnerable to fiscal instruments of climate policy, such as taxation and high energy prices. In general, women favor more risk-averse behavior and are more amenable to mitigation through lifestyle change (versus technology), but are less represented in climate policy-related jobs. The article notes one UNDP report where it is emphasized that "The tradeoffs forced upon people by climate shocks reinforce and perpetuate wider inequalities based on income, gender, and other disparities" (UNDP 2007).

In addition to the vulnerabilities of women, and their lack of representation in climate change responses, an examination of National Adaptation Programmes of Action by least developed countries shows that gender is not specifically addressed. As such, climate change and gender issues need to be "mainstreamed" and integrated into multi-sectoral policies and administrative procedures. A few instances of this, such as the Gender and Disaster Network and the Gender and Water Alliance, exist to help women participate in solutions, access climate change and disaster preparedness information, and participate in capacity building. Gender Impact Assessments and Gender Budgeting provide tools for mainstreaming gender issues. One conclusion from this article is that since carbon emissions will rise with population, unmet FP need could be an opportunity for donors to contribute to decreasing population, and thus, emissions.

7) Callister, L.C. 2008. "Among the Most Vulnerable: Women and Children in Global Disasters." *MCN The American Journal of Maternal/Child Nursing.* 33(4): 263.

Women experienced differential mortality during the Asian tsunami compared to men. One woman survived for every three men. This was because women were tasked with carrying children, protecting the elderly, and were often in clothing that impeded swimming or their ability to climb trees. In the aftermath, women also were vulnerable to intimate partner violence and sexual violence in shelter/refugee settings. Women also have more difficulty securing the official documents to gain access to food, health care and social services in disaster aftermath. Social expectations of women (e.g., dress and behavior) also impeded women from seeking aid or fleeing. These gendered responsibilities and expectations not only hinder women during disasters but also leave women with less time and energy to devote to alleviating economic burdens. In addition to the fact women are disproportionately vulnerable, it is also important for women to be a part of community-based disaster response because women

"tend to form groups, and mobilize the community to meet pressing needs with creative solutions." The president of Women Thrive Worldwide notes that disasters are inevitable, but the best way to mitigate their impact is to protect the poorest people, especially women, by making sure they are less poor and thus less vulnerable the next time disaster occurs.

8) Crosette, B. 2011. "Sharing and Sustaining Earth's Resources." In Kollodge, R. (Ed.). *State of the World Population 2011: People and Possibilities.* New York: United Nations Population Fund (UNFPA), pp. 92-99.

This UN report discusses, among many other things, the disproportionate burden of climate change on women and impoverished or marginalized populations. This argument is supported by the fact that in Southeast Asia, 221 million people live below the poverty line of $2 a day, and poor households lack the health care access and safety nets to fall back on during catastrophic situations, making it more difficult for them to accomplish adaptation-related tasks such as relocation and liquidation of resources. Additionally, on a national level, a poor country with a rapidly growing may have less capacity to adapt to climate change. For example, one potential climate change problem that would be exacerbated by rapid population growth is migration from low lying coastal areas to urban areas, which may not have the services/housing/jobs adequate for an influx of new residents. Slowing down urbanization would also help cities in the developing world that don't yet have the infrastructure to support rapid migration/growth, such as sanitation, clean public water supplies. The Horn of Africa drought/famine also is highlighted as evidence that response to climate change must be integrated to include addressing both rapid population growth and reduced arable land, both of which act to stress resources. Because women are "hardest hit by environmental problems," more likely to experience poverty, have less power over their own lives and economic productivity, and bear heavy burdens in reproduction and child raising, it is important for voluntary FP to be in place to help women adapt to drought and climate change-related events.

9) Engelman, R. 2009. *State of the World Population, Facing a Changing Climate: Women, Population, and Climate.* New York: United Nations Population Fund.

This UN report begins by introducing the state of climate change and providing background of the discussion regarding slowing population growth as a mitigation strategy. It then discusses how women, with their special knowledge of local horticulture, can be a part of the climate solution through environmental stewardship and increased participation in climate change response. Furthermore, since women suffer a disproportionately heavy impact from climate change, due largely in part to their socioeconomic status, it is essential to "mainstream" gender, age, and diversity into the climate change response. Climate change also can undermine the Millennium Development Goals, which address schooling, poverty, maternal and child health, and HIV, further disrupting a society's resilience to climate change, which Engelman defines as "the assets, capacity, and flexibility" that enable people to withstand and adapt to rapid change without "significant loss of life, health and well-being." Additionally, the author explains that gender equality and access to reproductive health are central to building resilience. The author also argues, citing evidence from two studies, that reproductive and familial obligations limit women's involvement in "economic, civic and political life," further impeding resilience and exacerbating vulnerability. Although this UN report proves an illustrative background, there is limited evidence provided specifically about *how* exactly reproductive health and gender equality work to effect increased climate change adaptation, which is one of this paper's limitations.

10) Silverstein, L. 2008. "Review: Guidelines for Gender-Sensitive Disaster Management." *Reproductive Health Matters*. 16(31):153-158.

In the aftermath of disaster, women's reproductive health needs and sanitation requirements are overlooked because those setting up aftermath response do not involve women at the decision making level. In refugee camps in post disaster situations in Asia, there is a "systematic pattern of violations of women's human rights." Women's accounts (survivors and NGO workers) are documented for analysis. The authors find the following results: pregnant women are given no care (resulting in miscarriage

and premature birth); breastfeeding mothers are not accommodated; women are often given 1 adult portion of food/supplies to share among their children; women are not involved in supply procurement/allocation so basic hygienic supplies were not accessible and in short supply; women had no private place to bathe; due to land inheritance rules, women were refused recognition as head of households, even if their families were deceased; sexual violence was prevalent. In India, Sri Lanka, and Indonesia, 80% more women than men died during the 2004 tsunami. Women constitute more victims, but have less of a voice in decision making, which needs to change to address these rights violations. In the introduction to the set of papers in this issue of the journal where this article appears the editors note that this issue of the journal "suggests the impossibility of isolating sexual and reproductive health and rights from a complex web of circumstances often hidden in more 'normal' settings."

Women and Paths to Climate Change Adaption

11) Bryant, L., Carver, L., Butler, C.D., Anage, A. 2009. "Climate Change and Family Planning: Least-Developed Countries Define the Agenda." *Bulletin of the World Health Organization*. 87(11):852-7.

An analysis of 40 National Adaptation Programmes of Action (NAPAs) written by least developed countries and submitted to the Global Environment Facility for funding shows that 93% of least developed countries appreciate the linkage between demographic trends and climate change. The three identified linkages between population and climate change included faster degradation of natural resources, increased demand for natural resources, and increased vulnerability to weather-related disasters. This relationship makes a case for voluntary access to family planning to be available to the poor citizens of least developed countries so they are better able to protect their environment and decrease their own vulnerability. The paper stresses that this approach is distinct from the mitigation angle, which suggests least developed countries decrease their population growth in order to avoid carbon emissions. Instead, this approach prioritizes the welfare of poor countries affected by climate change and notes that family planning could improve their well-being and help them deal with resource stress and vulnerability. Additionally, the paper calls for more support for rights based family planning services as an important component of NAPAs.

12) Carvajal-Escobar, Y., Quintero-Angel, M., Garcia-Vargas, M. 2008. "Women's Role in Adapting to Climate Change and Variability." *Advanced Geoscience*. 14: 277-280.

Climate change and variability has a disproportionate impact on developing countries and especially on women in these countries. Lack of equity has led to women being excluded from climate change adaptation strategies. More gender awareness in disaster prevention is recommended in the literature, as well as the recognition of women as especially effective players in community organizing, environmental stewardship, and as purveyors of environmental knowledge and skills. Additionally, women's gender-related conditions and needs should be considered to enable them to play a larger role in climate change response and leadership. Reproductive health is one of these gender-related needs that has effects on income, health, power structures, decision making, and feelings of self-efficacy. The study also asserts that it is important to recognize the "productive, reproductive and community roles" of men and women, as well as "practical and strategic gender-related needs," including food, income and health care, and also the status and power structures within the community. Strategic needs can be gaining legal rights, closing wage gaps, and protection against domestic violence, all of which require shifts in the structures and attitudes within a community.

13) Cohen, J. E. 2010. "Population and Climate Change." *Proc Am Philos Soc*. 154(2): 158-82.

Climate change includes interacting dimensions of population, economics, culture and environment. By 2050, the population is projected to be older and more urban and more than 90% of global urban growth will occur in today's developing countries. Recently, population and carbon emissions have grown much more quickly in developing countries than in high income countries. In developing countries, the emissions-to-population growth rate was 2.8, versus 1.6 in higher income countries. CO_2 and other GHG emissions are determined by demographic factors like the size and density of settlements, and household age and size, all of which will change, thereby affecting climate change. Three kinds of responses can address climate change related demographics: education, family planning/maternal health, and efficient urban design. These responses are worthy in their own right for improving people's well-being, and also may stop, decrease, or mitigate the impacts of climate change. Education, reproductive health, and efficient urban design are also desirable because they can benefit the larger global community, reducing poverty and GHGs.

14) Dhungel, R., Ojha, R.N. 2012. "Women's Empowerment for Disaster Risk Reduction and Emergency Response in Nepal." *Gender and Development*. 20(2): 309-321

It is established that women are more vulnerable to disaster and have gender-related needs during times of crises. In Nepal, behavioral and social expectations restrict women's ability to express their needs to aid workers, who

are typically strangers, during disaster relief/preparation. These factors exacerbate women's vulnerabilities. Thus, in 2008, the Disaster Risk Reduction and Humanitarian program (DRR-HP) in Nepal introduced the empowerment of women as a crucial factor in "community based disaster risk reduction interventions." Forty-two Women's Empowerment Centers took part in leading disaster risk reduction work in the local community, becoming an effective means of decreasing physical and socioeconomic vulnerability, while enhancing women's empowerment and roles as community leaders.

15) Engelman, R. 2010. *Population, Climate Change, and Women's Lives.* Washington, DC: The Worldwatch Institute.

Slower population growth and an eventual decline in the world population would help to reduce future greenhouse gas emissions, as well as help countries adapt to climate-related changes that are the result of previous emissions. Since a large portion of population growth today is due to unintended pregnancies, educating women and empowering them to make their own reproductive decisions would reduce fertility, allow women to better space their births, and decrease high-risk births to mothers who are very young or in advanced maternal age. This shift in population dynamics would help to improve equity between women and men, and improve the resilience of women, which is especially important since low-income women and children are among the most vulnerable to the effects of climate change. Empowering women and girls as potential "agents of change" is both "pragmatic and necessary" since women are in charge of production and consumption practices that can reduce carbon emissions. In the developing world, women are often the farmers and stewards of the environment and practice farming that pulls carbon out of the atmosphere, sequestering it in soil and vegetation. Women also tend to be more risk averse and conservative, compared with men. With cooperative and future-oriented attitudes toward leadership, women can contribute greatly to the adaptive capacity of a society. More and more, women also are participating as policy makers and negotiators. These contributions to environmental protection will become even more impactful as women gain more equitable footing with men in the economic, legal, and behavioral (including sexually and reproductive) spheres. In order to achieve equity for women, Engelman asserts that strategies can be viewed in three parts: "1) eliminating social, institutional, cultural barriers to women's full legal, civic and political equality with men; 2) improving education for all children, especially among girls and women; and 3) ensuring all women and their partners have access to and full freedom to use reproductive health and FP services so that the highest proportion possible of births results from parents' intentions to raise a child to adulthood." To make these changes, policy makers need to understand the root of population changes and direct concerted effort toward the improvement of maternal and child health and access to comprehensive, client focused family planning services.

16) Hardee, K., Rovin, K., Kidanu, A. 2009. *Linking Population, Fertility and Family Planning with Adaptation to Climate Change: Views from Ethiopia.* Washington, DC: Population Action International.

This study was conducted in Ethiopia in 2008-2009 using qualitative methods to examine how communities cope with climate change, what they need to adapt, who is the most vulnerable, and how RH/FP fits into resilience. The study used the VRIM Framework to determine a country's sensitivity (susceptibility of infrastructure, people, systems, health) and adaptive capacity (civic/human resources, economic/environmental capacity). It chose Ethiopia as the country of study specifically because it ranks very low on the VRIM index. Ethiopia is very vulnerable due to poverty, natural drought cycles, reliance on rain-watered farming, environmental degradation, and food stress. Ethiopia also has a young age structure, and the population is projected to more than double by 2050; it is predominantly rural but quickly urbanizing. However, the study sample was not a nationally representative sample and generalizability is limited because there may be bias or inaccuracy in participants' recollection of climate change-related events versus other anthropogenic-related events. The results of this study show that most people are aware of climate change, through either personal observation or environmental information from the media. They perceived that women and children are the most vulnerable to climate change. Women are vulnerable because they are in charge of domestic activities (farming,

livestock, searching for water) and childcare, and also experience birth-related morbidities. Children have their education disrupted during climate shocks and disaster and experience more susceptibility to nutritional morbidity and malaria, water-borne disease, and migration. It is noted that smaller families may be better suited for migration as children are particularly vulnerable in transit. The reported impact of climate change on livelihood included abandoned farms, lost cattle, conflicts, high food prices, displacement from land, and migration to cities. Participants identified family size as a determinant of household resilience, due to the needs of women and children, and identified families with fewer children as better positioned to handle climate-related challenges. Temporary migration; traditional/informal savings and loans associations; participation in NGO/government programs, such as planting trees and building dams; reliance on local government support; terrace farming; and varying crops were cited as coping strategies. Participants also expressed that the government should shoulder the responsibility for helping people gain resilience and that government/NGO resettlement programs, irrigation projects, microfinance, disaster preparation, and safety net programs also were helpful. Lastly, participants frequently mentioned family planning as a component of adaptation strategies that would enhance resilience. Recommendations included: 1) "Support integrated approaches to climate change adaptation that build on people's expressed needs, and strengthen community-based adaptation strategies to include expanding access to RH and FP services;" 2) "Give more high level policy support to Ethiopia's reproductive health and family planning programs to reduce unmet need for contraception and improve MCH;" and 3) Include FP, population, RH, and fertility in future impact, adaptation and vulnerability studies.

17) Klingholz, R., Topfer, K. 2012. "The Growth Trilemma: Population Growth, Energy Consumption and Climate Change – Three Problems, No Solution?" Berlin: Berlin Institute for Population and Development.

In this paper, Klingholz and Topfer argue that development is necessary to fight poverty and a country needs a sufficient energy supply to compete economically with other countries for goods and services. Moreover, demographic factors can change age structures and also play a role in development and economic growth, as evidenced by the Tiger States in Asia (China, South Korea, and Singapore). Overall, economic development and improved education, in tandem with family planning services, lower infant mortality, and greater gender equality create circumstances to enable women to have fewer children. The authors argue that when women have the opportunity to decide their family size and birth spacing, they choose to delay first births, have fewer children, and space births farther apart. They note that in the 48 least developed countries there has been very rapid economic growth but an increase in the absolute number of impoverished people, due to the dramatic population growth. Although births are going down, the population is still growing due to population momentum. This paper concludes that education is the best adaptive strategy for lowering births and making it possible for Africa to develop, but not in the environmentally destructive trajectory that other countries have followed. The paper asserts that education and lower birthrates, and economic success will help countries escape untenable population growth. Education will enable poor countries to use their demographic dividend to stimulate growth and help countries deal more easily with climate change challenges.

18) Malone, E. L., Brenkert, A. L., Delgado, A. 2011. "Climate Change Resilience and Universal Access to Family Planning." PAI Working Paper 2011. Washington, DC: Population Action International and Joint Global Change Research Institute.

Malone et al. conduct an analysis of seven countries (Bangladesh, Nepal, Haiti, Ethiopia, Kenya, Malawi, Uganda) using two climate change focused models (VRIM, and GCAM - Global Change Assessment Model). GCAM looks at energy, food production, economic prosperity, and provides the information to "set the context" for VRIM, which produces measures of resilience, food and water security, health resilience, human and civic resources, environmental capacity. Two different population projection scenarios are described: medium variant UN and UAFP-universal access to family planning. Resilience to climate

change was consistently higher (by between 2-10%) under the UAFP population projection. Most of the seven countries were projected to improve in health and human/civic resource resilience by more than 30%, and all countries improved more under the UAFP scenario. Environmental capacity was projected to decline for all countries, but less so under the UAFP scenario and food security projections varied widely. The limitations of the methodology and the models were mentioned and include: lack of interaction coefficients for VRIM, and a lack of accounting for relationships between people, labor productivity, growth rate, and life expectancy for GCAM. The desired characteristics that increase resilience to climate change overlap with those that result from family planning: better education, better health, more productive families and individuals.

19) Moreland, S., Smith, E. 2012. "Modeling Climate Change, Food Security, and Population." Durham, NC: The Futures Group.

In this paper, the Futures Group developed a simulation that combines population projections (which takes into account climate change and agriculture) and a food requirements model. This model was tested and piloted in Ethiopia, and showed how measurably instrumental family planning could be toward adapting to food stress. Food consumption and requirements are influenced by population composition, size, structure, supply, price, income. Slower growth not only changes the size of the population, but also the age/sex structure, which can change consumption/requirements. Food security problems in Ethiopia will be exacerbated by climate change but family planning is shown as having potential to address the food security issue. The overall model integrates three components: 1) population using projections (DemProj, with a FamPlan sub component); 2) food requirements necessary to maintain health; and 3) food consumption, as determined by economics (using GLOBE model, accounts for within and between country interaction). Results show that food security under low population growth and climate change is less problematic compared with a scenario of high population growth and climate change. The model even suggests that by 2050, slower population growth may overcome the effect of climate change on food insecurity. Thus, this model is a helpful starting point when discussing family planning as an adaptive strategy for climate change-related food stress and can also act as an "evidence-based advocacy tool" that highlights family planning as a potential adaptation strategy for climate change. However, some limitations are the fact that this model focuses on national level/macro measures of food security and doesn't account for inequalities of distribution within a country. Additionally, the nutritional content of food is not really considered and as such, high calorie diets may not necessarily fulfill nutritional requirements.

20) Mula, R. P., Wani, S. P., Rai, K.N., Balaji, V. 2010. "Lessons from Women's Participation in ICRISAT R4D Projects: Talking Points for Climate Change Initiatives." *Climate and Development.* 2(4): 378-389.

The International Crops Research Institute for the Semi-Arid Tropics in its research for development (R4D) projects shed light on how to better include and empower women in physical and social spaces, to inform facilitation of women's involvement in climate change initiatives. To better bring about women's participation in climate change projects, it is important to understand social construction and negotiation, to value users' perspectives in navigating the local economy and social networks, and to highlight the concrete economic benefits of participation. Social networking, in particular, is cited as crucial for exchanging information, scaling up activities, and ensuring a safety net during difficult times. Additionally, lack of control over resources can affect morale and perceptions of self-efficacy, which also are crucial for empowerment. Domestic obligations can get in the way of this participation in social networking. Reducing women's drudgery in domestic and agricultural work, both of which are increasingly difficult during climate fluctuations, can also improve women's inclusion in climate change initiatives. Implementing these lessons led to women making a difference in the areas of village and organizational leadership, livelihood management and knowledge management, all of which are critical in addressing climate change impacts.

21) Mutunga, C., Zulu, E., De Souza, R.M. 2012. "Population Dynamics, Climate Change and Sustainable Development in Africa." Washington, DC and Nairobi: Population Action International and African Institute for Development Policy.

Africa is the only continent projected to keep growing in population past 2100. The UN medium variant projection predicts the population increasing from 1 billion in 2010 to 2.1 billion in 2050, driven by sub-Saharan Africa countries, which are also the least equipped to adapt to changes. This document makes specific policy recommendations: 1) integrate policies across sectors; 2) make population a priority in national climate change development plans; 3) prioritize meeting women and partners' reproductive health needs, which can reduce poverty, protect natural resources, reduce inequality and encourage social development; 4) improve technical capacity of program design (informed by good research); and 5) incorporate reproductive health into institutions and frameworks for sustainable development.

22) Mutunga, C., Hardee, K. 2009. "Population and Reproductive Health in National Adaptation Programmes of Action (NAPAs) for Climate Change." In Guzman, J., Martine, G. McGranahan, G., Schensul, D., Tacoli, C. (Eds.). *Population Dynamics and Climate Change.* New York: UNFPA, pp. 176-191.

Countries that have consumed the least resources and emitted the least GHGs are likely to experience the most severe impact of climate change/global warming; this is inevitable according to all scenarios produced by the Intergovernmental Panel on Climate Change. Mitigation is important and emphasized in the 1997 Kyoto Protocol (37 industrialized countries' and the European community's commitment to reduce GHG emissions), but helping vulnerable countries adapt to future and current effects also is crucial. NAPAs were established as a part of Marrakech Accords in 2001 to assist least developed countries, which have high vulnerability and low adaptive capacity, with planning and procuring funding. To develop their NAPA, a country needs to: 1) include representation from various sectors (agriculture, water, energy, forestry); 2) integrate available information to assess baseline vulnerability; 3) identify and prioritize projects with help from stakeholders; and 4) submit a plan to UNFCCC. Currently, the mobilized funds available ($176 million USD) fall short of the estimated funding needs ($800 million). A review of NAPAs show that 37 out of 41 countries said population growth exacerbates vulnerability and adaptation to climate change through five ways: 1) food insecurity (falling fish stock, lack of arable land); 2) natural resource degradation (deforestation, ecosystem degradation, shoreline structure change); 3) water scarcity; 4) human health (waterborne disease in densely populated areas, congestion, respiratory disease during drought); and 5) migration and urbanization (loss of cultivable land and water stress send people to crowded, poorly planned, dirty cities). However, only six NAPAs mention reproductive health and link it to adaptation strategies and only two NAPAs (Uganda and Sao Tome Principe) identify a reproductive health project as a priority adaptation strategy. No NAPAs talk about funded reproductive health projects. Twenty-seven of these least developed countries are projected to double in population by 2050 and 80% of them have an unmet need for family planning of over 20%. These national plans prioritize urgent action, single sector moves, but fail to include any mention of FP/RH despite the repeated connections made between environmental concerns and population. Overall, the health sector also is identified as vulnerable to climate change by all countries, but health-related projects are ranked as a low priority, and only half of all countries propose any sort of health project in their adaptation plans. Since climate change adaptation funding is an issue, NAPAs could be integrated into current national development plans and poverty reduction strategies, which have a better likelihood of funding. Authors Mutunga and Hardee conclude by recommending that short term adaptation needs and long term development goals be linked to strengthen people's adaptability to climate change.

23) Page, A., Larsen, M. 2010. "The Empowerment of Women and the Population Dynamics of Climate Change." *Journal of Public Health.* 32(4): 590-1; author reply 591.

This paper argues that the provision of reproductive health services can be mitigation and adaptation related, helping to empower women and also reduce the number of births. RH and climate change remain unlinked in many national agendas, and it is important to integrate the two. It is also asserted that family planning can improve the adaptive capacity of poor communities and that women can act as agents of environmental change on a global level. The authors also argue that the "relationships between women's health, population outcomes, and climate well-being have been established,"although little qualifying evidence is cited to back this up. Examples were provided that demonstrated how women are more vulnerable than men during disaster. For instance, women and children are more than 14 times more likely than men to die during disaster. During the 2004 Asian tsunami, the largest fatalities were among women and children under 15. During a cyclone/flood in 1991 in Bangladesh, the women's death rate was five times higher than the men's death rate because women did not receive the warning information because it was communicated to men in public spaces and because women were not allowed to leave home without a male relative; some died waiting for an escort. In contrast, after Hurricane Mitch in Honduras, there were no reported fatalities, possibly because women were equally involved in risk management activities and took control of warning system and evacuation plans.

24) Stephenson, J., Newman, K., Mayhew, S. 2010. "Population Dynamics and Climate Change: What Are The Links?" *Journal of Public Health.* 32(2): 150-6.

This paper makes a case for population and climate change adaptation on a national level. Rapid population growth "endangers human development, provision of basic services and poverty eradication, and hinders poor communities' ability to adapt to change." Because population dynamics and climate change can be a sensitive issue, it is important for family planning programs to be administered within a rights framework. Additionally, population has not been consistently incorporated into climate change science and it is important, going forward, to consider how different kinds of dynamics, growth, migration, urbanization, aging, household size/composition may affect adaptation strategies. Stephenson et al. also emphasize that almost no country has risen from poverty without decreasing TFR and that the direct effect of lower fertility on economic growth and development is well established. The authors also suggest that smaller families can be an adaptation strategy for improved development and, thereby, improved climate change adaptability. Population growth is highlighted as worsening vulnerability, particularly as it can force migration to environmentally marginal geographic areas. For example, in Ethiopia, soil degradation and low agricultural productivity caused people to move and exploit new resources in an unsustainable way, perpetuating the cycle of unsustainability. Investment in family planning is critical to achieve both development and climate change goals and offers many interrelated benefits, such as reduced poverty, reduced maternal/child mortality, improved education outcomes, women's empowerment, and environmental sustainability. The authors conclude by making six recommendations: 1) invest in family planning; 2) promote rights based development; 3) contribute to adaptation; 4) Invest in female education to enable family planning; 5) develop skilled labor force to maximize demographic dividend; and 6) expand locally lead adaptation programs (NAPAs).

25) Thurairajah, N., Amaratunga, D., Haigh, R. 2008. "Enabling Women's Empowerment in Post Disaster Reconstruction." Construction and Building Research Conference of the Royal Institution of Chartered Surveyors. London.

Disaster relief resources go disproportionately to men over women. Empowerment is how women can be enabled to make strategic life choices to overcome these inequities and also to be a part of disaster resilient communities. This paper looks at women in disasters, the concept of empowerment, and the factors influencing it. It describes the mechanism by which women become empowered using six indicators that exist over three dimensions that are described for overcoming social, institutional and internal barriers to empowerment and the pursuit of self-interests for rural women. The aforementioned

three dimensions are familial, socioeconomic and psychological. The socioeconomic sphere includes economic contribution to household welfare, access to socioeconomic resources and ownership of assets. The familial dimension consists of women's participation in household decisions, such as: self-determination, bargaining power, control over resources, self-esteem, autonomy, and status and power relations within households, including decisions regarding reproductive health. The psychological dimension describes perceptions of gender awareness with regard to basic rights of women (including reproductive choices) and the coping capacity to different household shocks. Thus, the psychological dimension of gender awareness is an important dimension of disaster recovery. Reproductive health also can indirectly affect a woman' familial and socioeconomic spheres, which are also important components of empowerment.