CATALYZING INTEGRATION

Climate Change, Agriculture & Food Security

CATALYZING INTEGRATION SERIES

Efforts to reduce extreme poverty and achieve the Sustainable Development Goals (SDGs) require an in-depth understanding and reflection of the interconnected nature of people's lives. Development solutions need to be as multifaceted as the challenges they are designed to address. FHI 360 believes that an intentional, integrated approach to the design, delivery, and evaluation of programs has the potential to make an enduring difference in the lives we are dedicated to serve.

At its core, integration refers to activities in which actors from different sectors deliberately coordinate their work to maximize impact and progress toward common or complementary goals. Integration is most effective when it purposefully leverages opportunities to reach more people, offer better services, reduce inequality, or reduce costs.

FHI 360 has developed a **suite of resources** designed to advance integrated development approaches. Many of these resources also synthesize lessons learned and recommendations from integration across a diverse array of sectors. The *Catalyzing Integration Series* offers a closer look at integration between specific development sectors — including the rationale, evidence of impact, promising practices, key tools, and other technical guidance resources.

BACKGROUND

Despite decades of progress, there are approximately 702 million people living in extreme poverty[1] and the Food and Agriculture Organization of the United Nations (FAO) estimates that 795 million people worldwide remain chronically undernourished, the majority of whom live in low- and middle-income countries.[2]

795M
PEOPLE WORLDWIDE WHO ARE CHRONICALLY UNDERNOURISHED

9.8B
ESTIMATED GLOBAL POPULATION BY 2050, WHICH WOULD REQUIRE A 60% INCREASE IN AGRICULTURAL PRODUCTION TO FEED

If the current rate of food consumption continues, by 2050 a 60 percent increase in agricultural production will be required to feed an estimated global population of 9.8 billion people. As a result, food security[i] will remain an elusive goal for many in the developing world.[4] With the power to reduce crop production and food availability, climate change[ii] further threatens this goal.[2, 4, 6]

i. Food security is comprised of four dimensions: food availability, stability of food supplies, access to food, and food utilization.[3]

ii. Climate change, as defined under the United Nations Framework Convention on Climate Change (UNFCCC) is "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods."[5]

Climate Change, Agriculture & Food Security

In order to address food insecurity by increasing the availability of, and access to, food it must also be recognized that agricultural production is itself a driver of climate change. Greenhouse gas emissions result from land clearing, the use of fertilizers, livestock waste, and the storage and transportation of agricultural products. Climate change causes shifts in weather patterns, which increase the frequency of extreme weather events[iii] that directly affect crop production and threaten food security. If the current rate of greenhouse gas accumulation in the atmosphere continues, the effects of less predictable extreme weather events[iv] are likely to cause wide-scale food insecurity.[7]

Smallholder farmers and pastoralists[v] who mainly rely on rain-fed agriculture and predictable weather patterns for consistent production are especially vulnerable to the increasing unpredictability of extreme weather. For example, production of rice (a key food crop), could decline by up to 15 percent in low- and middle-income countries by 2050, and prices could increase by approximately one-third as a result of climate change.[9] Extreme weather events can also destroy the roads and facilities that support agricultural production, disrupt communications with markets, hinder food distribution systems, and cause further food insecurity.[7]

1/3

BY 2050, RICE PRICES IN LOW- AND MIDDLE-INCOME COUNTRIES COULD INCREASE BY APPROXIMATELY ONE-THIRD AS A RESULT OF CLIMATE CHANGE[9]

Without action, climate change could reduce the global caloric production of maize, soy, wheat, and rice by up to 24 percent by 2090.[10] Understanding and developing integrated programming that acknowledges the interaction between human activity (including agriculture production) and climate is critical to reducing the threat climate change poses to long-term food security.[11, 12] Essential to this two-way relationship is the need to maintain the integrity of the ecosystems and natural resources that are key to the prosperity of smallholder producers, and to increase the capacity of poor and vulnerable populations to adapt to climate change-related impact.[13] Indeed, food production in most low-to middle-income countries is largely dependent on both ecosystem services and natural resources, furthering the importance of an integrated programmatic approach.

↓24%

WITHOUT ACTION, CLIMATE CHANGE COULD REDUCE THE GLOBAL CALORIC PRODUCTION OF MAIZE, SOY, WHEAT, AND RICE BY UP TO 24 PERCENT BY 2090[10]

iii. Examples of extreme weather events include: greater variability in precipitation patterns that may result in more intense rain events that are less frequent, increased periods of dryness and drought, increased threat of flooding, and changes in the temperature and salinity in bodies of water.

iv. Scientists foresee significant sea level rise and coastal inundation, increased salinity, and significant disruption of food systems.[7]

v. Smallholders are small-scale farmers, pastoralists, forest keepers, and fishers who manage areas varying from less than one hectare to 10 hectares. Smallholder farmers are characterized by family-focused motives such as favoring the stability of the farm household system, using mainly family labor for production, and using part of the produce for family consumption.[8]

The Importance and Impact of Integrating Climate Change Interventions with Agriculture and Food Security Efforts

The linkages between climate change and food security are apparent. Weather, the timing and amount of rain, daily average temperatures, and the wind (among other factors) have profound effects on agricultural production and food security. Agricultural planners, managers, and farmers have long used the historical record and calendars to help determine which crops to plant, and when and where to plant them. But the historical record may no longer provide a road map.

Seasonal shifts in precipitation are increasing and becoming less predictable, changes in average daily temperatures affect seed germination, and some regions are experiencing greater periods of dryness while others experience extremely wet weather. All of these changes argue for a strong collaboration between climate-change scientists and agricultural practitioners, planners, and managers to address food insecurity on global, regional, national, and local levels.

Further, as the global population continues to increase, sustainable agricultural production that adapts and thrives under the changing climate will be critical to building resilience, particularly in low- and middle-income countries.[14] The World Bank estimates that approximately 70 percent of the world's poor and most food insecure populations live in rural areas and depend on their own crops as a primary source of food.[15] The ability of the rural poor to provide food for their households will be further challenged as climate change exacerbates degradation of natural resources and reduces agricultural productivity. For example, rural South Asia produces 15 percent of the world's wheat, but by 2050 production is projected to reduce by over half if climate change continues unabated.[16]

The relationship between food security and climate change is complicated by the role agriculture plays in contributing to climate change. Activities within food systems[vi] contribute between 19 and 29 percent of global greenhouse gas emissions; this figure rises to nearly 74 percent in low to middle-income countries.[18, 19] Food security programs must recognize the subtle relations between agriculture, climate change, and food security. Otherwise, programs will fail to deliver on sustainable production, a critical element of Sustainable Development Goal 12, which addresses sustainable consumption and production.[20] Integrated approaches naturally consider all three elements, a logical way forward in addressing the complex challenges faced by low- and middle-income countries.

Integrated programs—combining innovative agricultural techniques with activities designed to effectively respond to the effects of climate change and improve food security—can have significant impact across several dimensions.

vi. "Food systems encompass all the people, institutions and processes by which agricultural products are produced, processed, and brought to consumers. They also include the public officials, civil society organizations, researchers and development practitioners who design the policies, regulations, programmes, and projects that shape food and agriculture."[17]

Climate Change, Agriculture & Food Security

Ecosystems Services[21-23]

- Climate-friendly approaches to agricultural production—such as leaving plant litter and other biomass in place on the soil's surface—enhance the natural resource base and the systems that regulate the Earth's food, water, and nutrient cycles.
- Sustainable agriculture techniques that are site and context specific, such as no-till farming, protect the soil and water resources critical to food production.
- Efforts to maintain and protect the natural resource base to support sustainable food production reduce negative impacts on the earth's biodiversity and essential land resources (e.g. soil, trees), which serve as a carbon sink for greenhouse gas emissions.

Improvement of Livelihoods[24, 25]

- Climate mitigation and adaptation efforts that support sustainable food production help maintain the agricultural system, which provides jobs not only on farms but also in affiliated industries, such as food processing and transportation.
- Climate mitigation and adaptation programming increase the resilience of smallholder farmers to climate shocks as they are less likely to be dependent on food production as their sole source of income and are able to overcome periods of decreased agricultural production.
- Programs that seek to address climate change will reduce the threat of damage to infrastructure that could limit access to markets as well as hinder disaster response for affected populations.

Lower Greenhouse Gas Emissions[6, 16, 26]

- Climate smart land-use practices for food production lower greenhouse gas emissions through decreased land clearing and application of fertilizers and pesticides.
- Sustainable agricultural livestock management practices that take into consideration their role in climate change result in lower greenhouse gas emissions and increased production.
- Intentional integration in planning and management leads to lower greenhouse gas emissions by co-locating food production, processing, and infrastructure.

Climate Change and Food Security Enhance Efforts to Reduce Conflict[27, 28]

- A stable and resilient community that provides for its citizenry, grows the economy, and develops multiple means of income generation can overcome the shocks and stressors that accompany climate change and food insecurity.
- Limiting shocks from climate change supports sustainable crop production and agricultural sector employment, thereby maintaining and improving food security and eliminating a threat multiplier.
- In low- and middle-income countries, women are responsible for between 60 to 80 percent of food production and are more vulnerable to any conflicts that could result from reduced agricultural production. Research has shown that women's involvement in decision-making is critical for mitigating the impact of climate change.

Challenges and Entry Points

TENSIONS AND CHALLENGES

The interplay between climate change and food security varies across time and location, which prevents sweeping generalizations. A lack of actionable, downscaled data also hinders the ability to tailor activities to the needs of a specific region. For example, modeling suggests that if the current rate of climate change continues, maize production in Kenya could increase nearly 18 percent, whereas neighboring Uganda could experience a maize crop decrease of 9 percent by 2050.[29] Coffee crops, which are particularly sensitive to weather fluctuations, have already been harmed by climate change in both countries. The goals and objectives of climate-responsive economic programming and interventions are not always in agreement with economic plans at the national level. In addition, competition between agricultural export and food commodities for local or regional markets drives food insecurity as the shift away from subsistence farming to producing cash crops could occur.

Dissonance between Sectors

The overarching economic development policies of a country striving to improve livelihoods through infrastructure development can conflict with the goals of programs seeking to expand carbon neutral, green, and resilient economic development. In addition, where national economic (agricultural export and food commodities) sectors push farmers to produce cash crops that may have environmentally harmful effects, food security programs are working to build farmers' capacity to grow their own food sustainably, including through climate smart and climate change-responsive approaches. This is often the case with smallholder farmers, who are particularly susceptible to climate change-driven shocks and stresses due to their reliance on the natural resource base as a means of production. As climate change exacerbates degradation of the resource base (e.g., water, soil, and nutrients), and limits farmers' access to productive assets, they may find it difficult to adapt to new environmental conditions and produce subsistence crops.

ENTRY POINTS AND MODELS FOR INTEGRATION

As programmers and policymakers face the inevitable future of climate change and food insecurity, the entry points for integrating them should be further explored to achieve optimal impact. One approach is demonstrated through an emerging program in Ethiopia. Peace Centers for Climate and Social Resilience has developed an integrated approach that brings stakeholders together to mutually design and address interventions that build their adaptive capacity to manage climate change-driven natural resource scarcity. In essence, the program demonstrates how integrating climate change response through natural resource management and conflict resolution enhances the target community's resilience to climate change.

Climate Change, Agriculture & Food Security

Climate Smart Agriculture

Recent research and innovative approaches that integrate climate change science with agricultural production provide a road map for improving food security while adapting to and mitigating the effects of climate change. In particular, the emerging field of Climate Smart Agriculture (CSA), defined by the Food and Agriculture Organization (FAO) as agricultural practices that sustainably increase productivity and system resilience while reducing greenhouse gas emission. CSA combines climate change knowledge with agriculture, providing an indicator of what can be achieved through integration.[7, 30, 31] The three objectives of CSA include:

- **PRODUCTIVITY:** to increase sustainable agricultural production and agricultural related incomes to enhance food security and livelihoods.[30, 31]
- **ADAPTATION:** to promote and strengthen the ability of agricultural systems to adapt and become resilient in the face of climate change.[7]
- **MITIGATION:** to reduce the negative environmental impact of agricultural production through changes that lead to lowering the systems contribution to greenhouse gas emissions.[7]

Voluntary Family Planning Services

While climate change decreases available farmland, the world's population is simultaneously increasing. By 2100, the United Nations estimates that the global population will be more than 12 billion if family planning efforts are not improved.[32] Increased access to global, voluntary family planning methods will reduce unintended pregnancy and fertility rates, positively impacting both food security and climate in two important ways: (1) lessening demand on already overburdened agricultural systems and ecosystems, thereby reducing the greenhouse gas emissions that cause climate change; and (2) decreasing the amount of food needed, increasing food availability.[32, 33]

An integrated, multi-sectoral approach can meet the current unmet demand for family planning.[34] For example, the population, health, and environment (PHE) approach links climate adaptation and environmental improvement efforts with family planning and women's health.[28, 35]

Ecosystem Services Programming

The earth's human population is dependent on maintenance of ecosystem services[vii] for the water, soil, and nutrients necessary for agricultural production. Thus, efforts to protect and manage the earth's ecosystem will directly benefit climate change mitigation and adaptation, contributing to sustainable agricultural production and improvement of food security through a healthy ecosystem. This can be accomplished through land use management and attempts to stem deforestation and protect the earth's biodiversity through habitat protection, thereby contributing to agricultural landscape diversification. Also, cropping systems that leave ground cover in place (rather than open tilling) support soil health, enhance ground water infiltration, and result in decreased greenhouse gas emission.[2, 36]

vii. The complex and interactive system we see through the earth's natural resource base, the regulation of the global climate and other natural systems that support human life with food, clean water, and medicine is frequently referred to as ecosystem services.[2]

Climate Change, Agriculture & Food Security

Strategic Planning and Crop Diversification

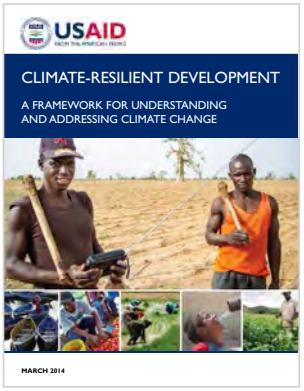
Integrated planning and management can reduce dissonance between those working on climate change and food security programming and those working in economic development. Further, through improved knowledge of climate change impacts on certain crops, scientists and agriculturalists can continue to identify crops that will flourish under the changed climatic conditions prior to reaching a crisis point. For example, numerous studies have shown that crop diversification can enhance resilience to climate change through improved resistance to pests and disease.[26]

These examples demonstrate that integrating climate change knowledge, agriculture, and food supply issues increases the possibility of achieving global food security and decreasing the negative impacts of climate change. Programming that brings together all three sectors will help build the evidence base needed for successful future endeavors as all countries seek to understand the interrelationships.

Climate Change, Food Security, and Conflict

Emerging evidence and research that examines the linkages and interplay between climate change, resource degradation, food security, and conflict is expanding, but the complex nature of the triggers for conflict and food insecurity and the role of climate change remain unclear.[37] Indeed, it is most accurate to say that much of the research that looks at these sectors in an integrated, multi-variable manner is at an early stage and a more complete understanding of the linkages is needed to develop appropriate programming. For example, recent research has suggested that climate change-driven migration of rural agricultural producers to urban centers was trigger in the ongoing Syrian civil war.[27] However, programming that brings together all three sectors in an integrated manner will help build the needed evidence base as countries seek to lessen the likelihood of violent conflict.

Key Tools and Resources



Climate-Resilient Development: A Framework for Understanding and Addressing Climate Change

Community Based Adaptation (CBA) Project Toolkit

Mercy Corps' Climate Resilient Development Approach

Climate Smart Agriculture Sourcebook, Food and Agriculture Organization (FAO)

Climate Smart Agriculture (ODI)

Climate Change, Agriculture & Food Security

REFERENCES

1. Da Cruz MJV, Foster J, Quillin B, Schellekens P. Ending extreme poverty and sharing prosperity: progress and policies. Washington [DC]: The World Bank; 2015.
2. The Food and Agriculture Organization of the United Nations, IFAD. The state of food insecurity in the world. Rome [Italy]: FAO; 2015 9251087857.
3. Schmidhuber J, Tubiello FN. Global food security under climate change. Proceedings of the National Academy of Sciences. 2007;104(50):19703-8.
4. Alexandratos N, Bruinsma J. World agriculture towards 2030/2050: the 2012 revision. Rome [Italy]: FAO; 2012 ESA working paper 12-03.
5. United Nations Framework Convention on Climate Change. Fact sheet: climate change science - the status of climate change science today. Bonn [Germany]: United Nations; 2011.
6. Tai AP, Martin MV, Heald CL. Threat to future global food security from climate change and ozone air pollution. Nature Climate Change. 2014;4(9):817-21.
7. Research program on climate change agriculture and food security. Climate change impacts people Copenhagen [Denmark]: University of Copenhagen; 2016. Available from: https://ccafs.cgiar.org/bigfacts/#.
8. The Food and Agriculuture Organization of the United Nations. Factsheet: smallholders and family farmers. Rome [Italy]: FAO; 2012.
9. Nelson GC, Rosegrant MW, Koo J, Robertson R, Sulser T, Zhu T, et al. Climate change: impact on agriculture and costs of adaptation. Washington [DC]: Intl Food Policy Res Inst; 2009.
10. Elliott J, Deryng D, Müller C, Frieler K, Konzmann M, Gerten D, et al. Constraints and potentials of future irrigation water availability on agricultural production under climate change. National Academy of Sciences. 2014;111(9):3239-44.
11. Campbell BM, Thornton P, Zougmore R, van Asten P, Lipper L. Sustainable intensification: what is its role in climate smart agriculture? Current Opinion in Environmental Sustainability. 2014;8:39-43.
12. Lipper L, Thornton P, Campbell BM, Baedeker T, Braimoh A, Bwalya M, et al. Climate-smart agriculture for food security. Nature Climate Change. 2014;4(12):1068-72.
13. Baquet Z. Facilitating discussion on the integration of climate change and natural resources management into food security and agriculture programs: a series of events. Knowledge Management for Development Journal. 2013;9(1):93-107.
14. United Nations Department of Economic and Social Affairs: Population Division. World population prospects: the 2015 revision key findings and advance tables. New York [New York]: United Nations; 2015 Working Paper ESA/P/WP 241.
15. The Food and Agriculture Organization of the United Nations: Gender Equity and Rural Employment Division. Decent rural employment for food security: a case for action. Rome [Italy]: Food and Agriculture Organization of the United Nations; 2012.
16. CGIAR. Mapping the menace of global climate change. Washington, DC: 2009.
17. The Food and Agriculuture Organization of the United Nations. The state of food and agriculture: food systems for better nutrition. Rome [Italy]: 2013.
18. Vermeulen SJ, Campbell BM, Ingram JS. Climate change and food systems. Annual Review of Environment and Resources. 2012;37(1):195.
19. The Food and Agriculture Organization of the United Nations. Enabling agriculture to contribute to climate change mitigation. Rome [Italy]: 2008.
20. United Nations Economic and Social Council, editor Progress towards the Sustainable Development Goals. High-level political forum on sustainable development; 2016; New York [New York]: United Nations.
21. Pedrono M, Locatelli B, Ezzine-de-Blas D, Pesche D, Morand S, Binot A. Impact of climate change on ecosystem services. Climate Change and Agriculture Worldwide: Springer; 2016. p. 251-61.
22. The Food and Agriculture Organization of the United Nations. Ecosystem services sustain agriculuture productivity and resiliance. Rome [Italy]: 2007.
23. TEEB. The economics of ecosystems and biodiversity Geneva [Switzerland]2016. Available from: http://www.teebweb.org/resources/ecosystem-services/.
24. Rainforest Alliance. Summary of climate-smart agriculture in the 2017 SAN sustainable agriculture standard. New York [New York]: 2016.
25. Wright J. Feeding nine billion in a low emissions economy: challenging, but possible. A review of the literature for the Overseas Development Institute. Oxford [UK]: Oxfam International, Overseas Development Institute; 2010.
26. Lin BB. Resilience in agriculture through crop diversification: adaptive management for environmental change. BioScience. 2011;61(3):183-93.
27. Brinkman HJ, Hendrix CS. Food insecurity and violent conflict: causes, consequences, and addressing the challenges. Rome [Italy]: World Food Programme; 2011.
28. Wedeman N, Petruney T, DeVoe WD, DiLanzo T, Deliver W, Dunn L, et al. Invest in women to tackle climate change and conserve the environment. New York [New York]: Deliver for Good; 2016.
29. Thornton PK, Jones PG, Alagarswamy G, Andresen J, Herrero M. Adapting to climate change: agricultural system and household impacts in East Africa. Agricultural Systems. 2010;103(2):73-82.
30. Harvey CA, Chacon M, Donatti CI, Garen E, Hannah L, Andrade A, et al. Climate smart landscapes: opportunities and challenges for integrating adaptation and mitigation in tropical agriculture. Conservation Letters. 2014;7(2):77-90.
31. Scherr SJ, Shames S, Friedman R. From climate-smart agriculture to climate-smart landscapes. Agriculture & Food Security. 2012;1(1):1.
32. Speidel J, Raifman S, Thompson K. By slowing population growth, family planning can help address food insecurity and climate change. San Francisco [California]: UCSF Bixby Center for Global Reproductive Health; 2015.
33. Moreland S, Smith E. Improving access to family planning can promote food security in a changing climate. Study summary: modeling climate change food security and population growth. Chapel Hill [North Carolina]: MEASURE Evaluation PRH; 2012 March. Contract No.: USAID Cooperative Agreement Associate Award GPO-A-00-09-00003-00.
34. Mutunga C, Hardee K. Population and reproductive health in National Adaptation Programmes of Action (NAPAs) for climate change in Africa. African Journal of Reproductive Health. 2010;14(4).
35. Yavinsky RW, Lamere C, Patterson K, Bremner J. The impact of population, health, and environment projects: a synthesis of the evidence. Washington [DC]: Population Reference Bureau; 2015.
36. Staropoli N. No-till agriculture offers vast sustainability benefits. So why do so many organic farmers reject it? : Genetic Literacy Project; 2016. Available from: https://www.geneticliteracyproject.org/2016/06/02/no-till-agriculture-offers-vast-sustainability-benefits-so-why-do-organic-farmers-reject-it/.
37. USAID. Climate change and conflict: an annex to the USAID climate-resiliant development framework. Alexandria [Virginia]: USAID; 2015.

INTEGRATED DEVELOPMENT DEPARTMENT
1825 Connecticut Ave NW
Washington, DC 20009
T: 202.884.8000
E: AskID@fhi360.org