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Herding Livestock Programs toward Nutrition

A Critical Analysis
with a Focus on
Rwanda's Feed the
Future Dairy Program

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A Report of the
CSIS GLOBAL FOOD SECURITY PROJECT

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Executive Summary

In 2010, the U.S. government launched Feed the Future, currently implemented in 19 focus countries with the ambitious goal of achieving a 20 percent reduction in levels of both poverty and chronic undernutrition. Strategies to achieve these goals were quickly developed, and in nine of the focus countries, livestock was identified as a potential sector of concentration for Feed the Future interventions. One of these countries is Rwanda, where Feed the Future has helped transform the dairy industry to be more productive and profitable for actors along the value chain through the Rwanda Dairy Competitiveness Program II (RDCP-II), implemented by Land O'Lakes International Development.

A focus on livestock within Feed the Future has the potential to drive both poverty and malnutrition goals: livestock and the foods produced from them are an important part of the livelihoods and diets of poor, rural households worldwide. Evidence suggests that livestock production can increase both income and consumption of animal-sourced foods (ASFs) in homes that own livestock—with a promising consequent reduction in chronic malnutrition.

Despite this potential, livestock programs, including those led by Feed the Future, are rarely designed to address chronic undernutrition. Rather, they are primarily focused on catalyzing change within dynamic market systems, improving terms of production and trade for smallholders. Decisions on what a family eats, however, are made at the household level, and it is hard to change nutrition behaviors through markets alone. Other environmental, policy, economic, and cultural dimensions—such as the role of women in livestock systems and their access to land and other resources—can either hamper or facilitate the success of livestock interventions.

The Feed the Future dairy program in Rwanda was designed to build linkages between dairy farmers, milk processors, and end-market consumers. Addressing chronic undernutrition was not a part of the dairy program's original goal, nor was it part of the broader Feed the Future strategy for Rwanda. However, a combination of strong leadership and flexibility on the part of both the donor and the implementing partner helped Feed the Future in Rwanda and RDCP-II shift gears to intentionally address chronic undernutrition. Using creative behavior change communications

interventions, the Rwanda dairy program successfully built nutrition strategies into existing activities in addition to developing new activities.

Conclusions and recommendations are based on both a review of the evidence linking livestock ownership to nutritional gains as well as on field research in Rwanda. Feed the Future programs in the livestock sector should integrate nutrition into their strategies from the beginning. To do so, livestock programs should be designed to:

- Target households that are undernourished or vulnerable to undernourishment;
- Consider what animal type is most appropriate for these households;
- Support women's economic and household empowerment as a means to improve family diets;
- Invest in behavior change activities that promote better nutrition;
- Monitor and evaluate livestock programs based on nutrition outcomes; and
- Identify and address the context-specific household, cultural, social, environmental, and political barriers to achieving nutrition goals through livestock.

Introduction

Chronic undernutrition is a significant problem in many developing countries, despite global gains in economic growth and poverty reduction. Worldwide, nearly one-quarter of all children under five years of age are stunted—with more than a third of that total in Africa.¹ Chronic undernutrition can lead to stunting, which is evident when children do not grow to optimal heights. Stunting carries long-term and irreversible human development risks if it is not addressed before children are five years old.² Children who are stunted often grow into adults with poor cognitive ability, which ultimately impairs their chances to prosper later in life. Children of adults who are stunted are often stunted themselves, perpetuating a cycle of poverty and stagnated socioeconomic development in communities where levels of stunting are high.³

In 2010, the administration of President Barack Obama developed the Feed the Future initiative, which aimed to reduce the levels of poverty and stunting by 20 percent⁴ in 19 focus countries where the prevalence of these conditions was especially high.⁵ Feed the Future is a part of the \$3.5 billion commitment to end global hunger made by President Obama in July 2009 at the L'Aquila summit of the Group of Eight (G8) industrialized nations.⁶ Five basic principles for food security were developed in L'Aquila and later endorsed at the November 2009 World Summit on Food

1. UN Children's Fund (UNICEF), World Health Organization (WHO), and World Bank, "Levels and Trends in Child Malnutrition: Key Findings of the 2015 Edition," September 2015, https://www.unicef.org/media/files/JME_2015_edition_Sept_2015.pdf.

2. F. Branca and M. Ferrari, "Impact of Micronutrient Deficiencies on Growth: The Stunting Syndrome," *Annals of Nutrition and Metabolism* 46, supp. 1 (2002): 8–17.

3. Anthony Lake, "Investing in Nutrition Security Is Key to Sustainable Development," UNICEF, 2012, http://www.unicef.org/media/media_62452.html.

4. Marian L. Lawson, Randy Schnepf, and Nicolas Cook, *The Obama Administration's Feed the Future Initiative* (Washington, DC: Congressional Research Service, 2016), <https://www.fas.org/sgp/crs/row/R44216.pdf>.

5. Melissa D. Ho and Charles E. Hanrahan, *The Obama Administration's Feed the Future Initiative* (Washington, DC: Congressional Research Service, 2011), <https://www.fas.org/sgp/crs/misc/R41612.pdf>.

6. Lawson, Schnepf, and Cook, *Obama Administration's Feed the Future Initiative*.

Security in Rome. Known as the “Rome Principles for Sustainable Global Food Security,” they call for investment in country-owned plans, better coordination of aid actors, addressing immediate hunger in addition to long-term food security, a more efficient multilateral system, and a commitment to multiyear plans and programs.⁷ These principles were used to guide Feed the Future’s development.

In many focus countries, the Feed the Future strategies include developing livestock value chains. Livestock (including poultry as well as ruminants) play a major role in the livelihoods of the rural poor and animal-sourced foods (ASFs) are a critical component of a nutritious, diversified diet. International standards for dietary diversity for women include three ASF food groups (eggs; dairy; and meat, poultry, or fish) among the nine that are tracked.⁸ Guidance for feeding children under the age of five also recommends including ASFs.⁹

However, the pathway from livestock ownership and the production of ASFs to reduced chronic undernutrition poses many obstacles: common cultural, economic, political, and environmental barriers to good nutrition still exist. The ability for livestock ownership and production to support Feed the Future’s goal of reduced stunting necessitates the integration of nutrition strategies into livestock-focused programs.

This report asks, what role can livestock have in achieving Feed the Future’s stunting goals? First, an examination of the ways in which livestock and ASFs contribute to better nutrition is detailed. A case study of a Feed the Future dairy program in Rwanda is then presented to explore how livestock programs can contribute to better nutritional outcomes. The case study is followed by a synthesis of the constraints and opportunities to achieving nutrition goals through livestock programming. Finally, recommendations are made on how Feed the Future programs that focus on livestock and ASFs can be oriented to reduce stunting.

7. Food and Agriculture Organization (FAO), “Declaration of the World Summit on Food Security” (Rome, November 16–18, 2009), <ftp://ftp.fao.org/docrep/fao/Meeting/018/k6050e.pdf>.

8. FAO and FHI 360, *Minimum Dietary Diversity for Women: A Guide to Measurement* (Rome: FAO, 2016), <http://www.fao.org/3/a-i5486e.pdf>.

9. UNICEF, *Programming Guide: Infant and Young Child Feeding* (New York: UNICEF, 2011), http://www.unicef.org/nutrition/files/Final_IYCF_programming_guide_2011.pdf.

Role of Livestock to Improve Nutrition and Food Security

Supporting 1.3 billion people globally, the livestock sector plays an important role in livelihoods around the world.¹ This is especially true for the rural poor; it is estimated that 752 million poor (living on less than \$2 per day) smallholder farmers own livestock.² Animal-sourced foods (ASFs) from livestock also play a major role in meeting human nutrition needs. Livestock contributes to 13 percent of global calories and 28 percent of the protein consumed globally directly through the provision of meat, milk, eggs, and offal.³ These foods also provide essential vitamins and minerals (see Box 2.1).

Given the important role of livestock in the lives of the rural poor and for human nutrition, livestock interventions present an opportunity to improve nutrition in poor, rural households. Agricultural programs with nutrition goals often focus on crops and vegetables, however. Out of the dozens of Feed the Future activities implemented in the 19 focus countries, very few activities exclusively focus on livestock and only nine of the countries include a livestock component. Most livestock programs are not designed to improve nutrition, making their contribution to nutrition goals improbable.⁴

To realize nutrition benefits, livestock strategies must explicitly incorporate nutrition outcomes. There are two primary pathways for livestock to contribute to better nutrition in rural households (see Figure 2.1). The first pathway is direct, through the consumption of ASFs by those that produce them. The second is indirect, by increasing income that households can use to purchase nutritious foods. Along both of these pathways, the role of women in household decisionmaking

1. Philip K. Thornton, "Livestock Production: Recent Trends, Future Prospects," *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences* 365, no. 1554 (2010): 2853–2867.

2. J. Otte et al., *Livestock Sector for Poverty Reduction: An Economic and Policy Perspective—Livestock's Many Virtues* (Rome: FAO, 2012), <http://www.fao.org/docrep/015/i2744e/i2744e00.pdf>.

3. FAO, *World Livestock 2011: Livestock in Food Security* (Rome: FAO, 2011), <http://www.fao.org/docrep/014/i2373e/i2373e.pdf>.

4. Paula Dominguez-Salas et al., "Mainstreaming Human Nutrition in Livestock Interventions: Lessons Learnt from a Capacity-Building Workshop for the Sahel Region," *Field Exchange* 51 (2016): 82–84.

BOX 2.1. Nutrition from Animal-Sourced Foods

ASFs provide macronutrients that are necessary for human health and growth. Chronic undernutrition, which can lead to stunting, is often a result of inadequate energy and protein consumption. Protein from meat, fish, eggs, and dairy, for example, contributes to cell growth in the human body. Unlike most plant-based foods, protein from ASFs is more balanced, providing all essential amino acids necessary for human nutrition.¹ The sugary lactose found in milk serves up carbohydrates that are rapidly converted into body energy. ASFs are also sources of fats that bear essential vitamins such as A, D, and E.

ASFs contain many micronutrients required for healthy body growth and function. Although most micronutrients can be obtained from plant-sourced foods, even small amounts of animal-sourced foods provide many of the vitamins and minerals that are often inadequate in exclusively plant-based diets. Iron from meat (called “heme iron”) is more easily digested than iron from plant sources (or “non-heme iron”).² People relying on plant-based diets must consume 80 percent more iron from plant-based sources than if they were to obtain iron from animal-based sources.³ Dairy provides a denser source of calcium than most plant-based sources. Similarly, a higher volume of fruits and vegetables must be consumed to meet the same vitamin A requirements satisfied by a small amount of ASFs. Unlike other essential nutrients, vitamin B-12 is only found in ASFs.⁴ Supplementation with synthetic vitamin B-12 is expensive and not practical for impoverished families in remote, rural settings.

1. Carol Byrd-Bredbenner, Gaile Moe, Donna Beshgetoor, and Jacqueline Berning, *Wardlaw's Perspectives in Nutrition* (New York: McGraw-Hill, 2009).

2. Ibid.

3. Suzanne P. Murphy and Lindsay H. Allen, “Nutritional Importance of Animal Source Foods,” *Journal of Nutrition* 133, no. 11 (2003): 3932S–3935S.

4. Ibid.

on how livestock and animal-sourced foods are managed is a key determinant to achieving nutrition goals. As the director general of the International Livestock Research Institute, Jimmy Smith, and his coauthors explain: “The combined impacts of meeting nutritional needs and providing income make livestock a powerful force for the poor.”⁵

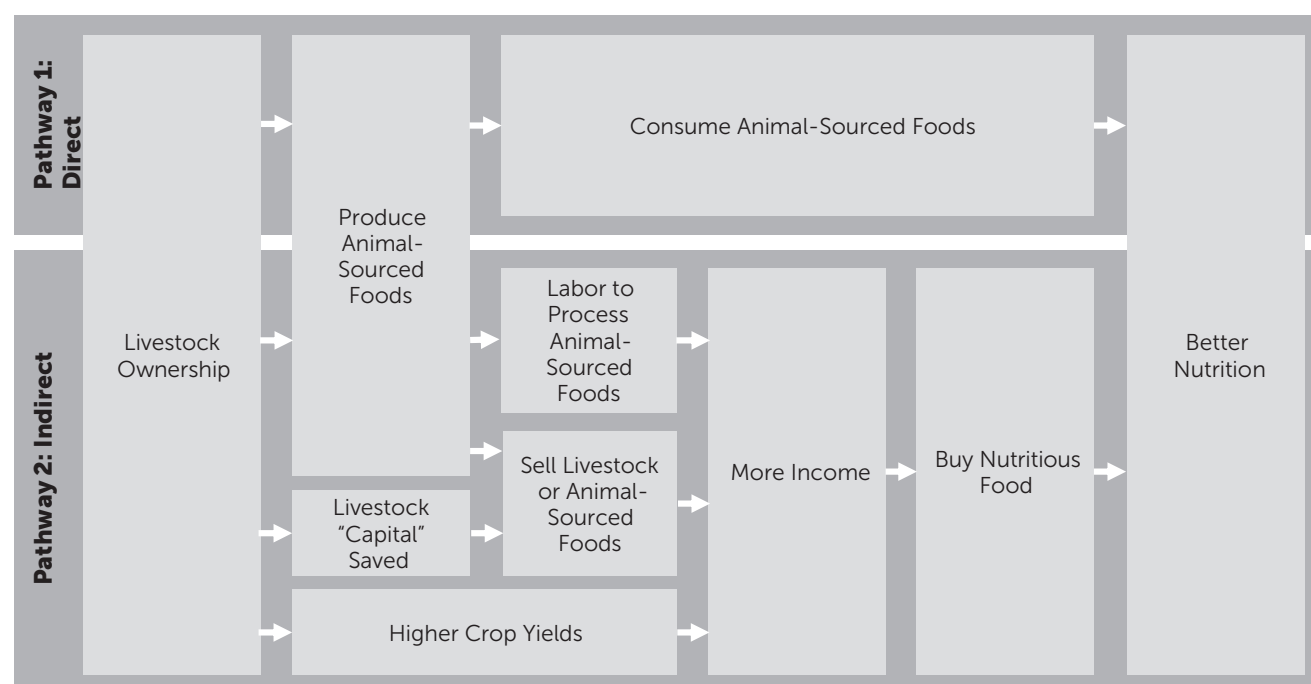
A DIRECT PATHWAY: NUTRITION FROM ANIMAL-SOURCED FOODS

ASFs provide complete proteins, energy, and micronutrients that are often limited in the diets of the poor.⁶ Milk, for example, is one of the most important sources of protein and energy for young

5. Jimmy Smith et al., “Beyond Milk, Meat, and Eggs: Role of Livestock in Food and Nutrition Security,” *Animal Frontiers* 3, no. 1 (2013): 6–13.

6. Rosemary Rawlins et al., “Got Milk? The Impact of Heifer International’s Livestock Donation Programs in Rwanda on Nutritional Outcomes,” *Food Policy* 44 (2014): 202–213.

Figure 2.1. Livestock to Nutrition Pathways



children in the highlands and drylands of Ethiopia in an otherwise highly undiversified diet.⁷ Pastoralists around the world often manage a variety of milking animals, such as sheep or goats in addition to large ruminants and camels, to ensure that milk is available for children in the dry season when larger animals graze further from homesteads.⁸ It is difficult to meet children's required daily intake of certain micronutrients, such as calcium and vitamin B-12, with a plant-based diet and with poverty-level incomes.⁹ Vitamin D deficiencies, for example, are unusually high in poorer regions of the world, where milk and other ASFs that contain vitamin D (such as fish and eggs) are unaffordable.¹⁰ Improved access to ASFs could meaningfully impact undernutrition levels in low-income areas.

Increasing the production of ASFs in livestock-owning households could augment the consumption of those foods. Children living in livestock-owning households are less likely to be stunted,

7. J. Hoddinott, D. Headey, and M. Dereje, "Cows, Missing Milk Markets, and Nutrition in Rural Ethiopia," *Journal of Development Studies* 51, no. 8 (2015): 958–975; Kate Sadler and Andy Catley, *Milk Matters: The Role and Value of Milk in the Diets of Somali Pastoralist Children in Liben and Shinile, Ethiopia* (Addis Ababa: Feinstein International Center/Tufts University, and Save the Children, 2009), <http://fic.tufts.edu/assets/Milk-Matters-in-2009.pdf>.

8. Kate Sadler et al., *Milk Matters: A Literature Review of Pastoralist Nutrition and Programming Responses* (Addis Ababa: Feinstein International Center/Tufts University and Save the Children, 2009), <http://fic.tufts.edu/assets/Milk-Matters-review.pdf>

9. Rawlins et al., "Got Milk?"

10. Murphy and Allen, "Nutritional Importance of Animal Source Foods."

regardless of household poverty levels.¹¹ But context matters, and poor families may prefer to sell ASFs they produce rather than to consume them at home.

AN INDIRECT PATHWAY: FOOD SECURITY AND POVERTY REDUCTION

Producing and marketing ASFs is an important source of income for smallholder farmers and pastoralists. Demand for meat, milk, and eggs will grow substantially over the next several decades, driven by a combination of rising incomes, urbanization, and population growth.¹² In sub-Saharan Africa, for example, demand for ASFs is expected to double between 2000 and 2050.¹³ This demand growth represents a significant business opportunity for rural livestock owners.

Livestock ownership can reduce household poverty in two primary ways. First, the sale of ASFs can lead to increased incomes. Second, livestock ownership can serve as a form of insurance for households, insulating them from the most severe effects of climate, conflict, economic, or health shocks.

Livestock Production for Income Generation

Poor households often sell livestock and ASFs for income rather than consuming the products themselves.¹⁴ Proceeds can be used to purchase food, services (including children's education or healthcare), or other household investments to improve well-being. Accumulating livestock can represent a tipping point at which poor families can step out of poverty with investments that increase and diversify income and reduce vulnerability.¹⁵ Livestock also can improve productivity on crop and vegetable farms (see Box 2.2).

Accumulating livestock can represent a tipping point, when poor households can begin to step up and out of poverty.

Livestock ownership in poor, rural areas also benefits the broader community, since ASFs are generally sold and consumed locally, expanding market availability and access for these products. Livestock owners may employ other community members to provide veterinary or other services. Value chains for ASFs can generate substantial numbers of jobs and small business opportunities for rural households to slaughter animals, process meats and milk,

11. Carlo Azzarri et al., "Does Livestock Ownership Affect Animal Source Foods Consumption and Child Nutritional Status? Evidence from Rural Uganda," *Journal of Development Studies* 51, no. 8 (2015): 1034–1059; Emily M. Mosites et al., "The Relationship between Livestock Ownership and Child Stunting in Three Countries in Eastern Africa Using National Survey Data," *PLoS ONE* 10, no. 9 (2014): e0136686.

12. Thornton, "Livestock Production"; Smith et al., "Beyond Milk, Meat, and Eggs."

13. Thornton, "Livestock Production."

14. Smith et al., "Beyond Milk, Meat, and Eggs."

15. Ibid.

transport animals and ASFs, and more.¹⁶ These alternative income-generation opportunities increase the purchasing power of skilled individuals in rural communities where few other jobs exist.

BOX 2.2. Livestock in Crop or Vegetable Farms

In addition to providing income for rural households through the production and sale of ASFs, livestock provides crop and vegetable farmers with other benefits that can increase farm productivity and income. Manure and urine from livestock improve soil fertility for crop and vegetable farms, improving farm productivity, reducing the need for chemical fertilizers, increasing food availability, and lowering costs.¹ Manure from livestock supplies up to 12 percent of gross nitrogen input for cropping globally and up to 23 percent in mixed crop-livestock systems in developing countries.² Livestock also provides traction power for transportation and crop production.³ Although the use of animal-power in farms to till soil is declining globally, in the least developed corners of the planet, animal-power reduces human drudgery and increases crop and vegetable farm productivity. In sub-Saharan Africa, the number of draft animals in use is growing.⁴ Livestock production is also benefited by the production of crops and vegetables. Plant waste from crop and vegetable farms such as stover (the stocks from corn, rice, millet, or sorghum plants, for example) can be used to feed livestock that are confined.

1. T. F. Randolph et al., "Invited Review: Role of Livestock in Human Nutrition and Health for Poverty Reduction in Developing Countries," *Journal of Animal Science* 85, no. 11 (2007): 2788–2800; Rawlins et al., "Got Milk?"

2. Smith et al., "Beyond Milk, Meat, and Eggs."

3. Randolph et al., "Invited Review."

4. Smith et al., "Beyond Milk, Meat, and Eggs."

Livestock Ownership as Insurance: Implications for Resilience

Livestock ownership can prevent households from falling into poverty and becoming less food secure. The sale of ASFs such as milk, eggs, and poultry meat complements crop-based agriculture with a steady source of income: crops are harvested seasonally whereas livestock can provide income throughout the year, if not daily.¹⁷ Households that rely solely on crops may lack a reliable source of income for much of the year while waiting for the harvest. Livestock is also less sensitive to climate and weather shocks that affect crop yields because animals are mobile,¹⁸ although herding cattle long distances requires access to food and water along the way.

16. Ibid.

17. Jan Hoorweg, Piet Leegwater, and Willem Vererman, "Nutrition in Agricultural Development: Intensive Dairy Farming by Rural Smallholders," *Ecology of Food and Nutrition* 39 (2000): 395–416.

18. Simon Levine, "'What to Do about Karamoja?' Why Pastoralism Is Not the Problem but the Solution," FAO/ECHO, September 2010, <http://www.celep.info/wp-content/uploads/downloads/2011/07/what-to-do-about-Karamoja.pdf>; Helen Young et al., *Risk, Resilience, and Pastoralist Mobility* (Somerville, MA: Feinstein International Center/Tufts University, 2016), http://fic.tufts.edu/assets/TUFTS_1611_Risk_Resilience_mobility_V6_online.pdf.

Livestock can also be sold to cope with unexpected household expenses. In pastoral and agro-pastoral communities, livestock is often kept as a way to store savings or accumulate capital, particularly given a lack of suitable financial services. Despite a rapid rise in financial inclusion through mobile technology, only 54 percent of adults in developing economies, and just a third in sub-Saharan Africa, have bank accounts.¹⁹ When livestock-keeping households have an acute need for cash, livestock assets can be liquidated or used as collateral for a loan.²⁰ If a family member suddenly falls ill and is unable to work, for example, livestock owners may opt to sell an animal to make ends meet or take out loans against livestock and anticipated ASF production.

THE ROLE OF DIFFERENT TYPES OF LIVESTOCK IN NUTRITION AND FOOD SECURITY

Different types of livestock provide distinct nutrition and food security benefits. The potential impacts of owning and producing poultry, small ruminants (such as sheep or goats), and large ruminants (such as cows) on chronic undernutrition are examined here. Although this report focuses on how livestock ownership can affect stunting, in some cases other nutrition indicators such as wasting or underweight are explored (see Box 2.3 for an explanation of these different types of undernutrition).

Poultry

Poultry—including chickens, ducks, and turkeys—are raised to produce meat, eggs, and offal. Because poultry reproduce quickly, poultry products can be consumed or sold regularly. Modern chickens produce an egg every one to two days, but indigenous chickens kept by poor, rural households are far less productive due to scavenging diets and breed characteristics that may emphasize hardiness to the local environment as opposed to productivity. If eggs are fertilized and incubated, chicks will hatch approximately three weeks after being laid and require roughly six months to mature for meat or laying eggs themselves. Poultry require few inputs, making them suitable for poorer households with little access to land, water, and feed.

Ownership of poultry positively affects chicken and egg consumption, according to research in both Uganda and Bangladesh.²¹ Because poultry lay eggs regularly, households ostensibly could

19. Asli Demircug-Kunt et al., *The Global Findex Database 2014: Measuring Financial Inclusion around the World*, World Bank Policy Research Working Paper 7255 (Washington, DC: World Bank Group, 2015).

20. Thornton, "Livestock Production"; Randolph et al., "Invited Review"; Mary Khakoni Walingo, "Socio-Economic, Food and Nutrient Intake, and Nutritional Status Indicators Associated with Successful Livestock Development Programmes in Western Kenya," *African Journal of Agricultural Research* 7, no. 2 (February 2012): 153–163.

21. Azzarri et al., "Does Livestock Ownership Affect Animal Source Foods Consumption and Child Nutritional Status?"; Frands Dolberg, "A Livestock Development Approach That Contributes to Poverty Alleviation and Widespread Improvement of Nutrition among the Poor," *Livestock Research for Rural Development* 13, no. 5 (2001): 1–14.

BOX 2.3. Types and Measurements of Protein-Energy Undernutrition

Feed the Future identified stunting as the target indicator for hunger reduction because it is “the best surrogate indicator for nutritional status.”¹ Stunting reflects chronic undernutrition, which suggests a child has consumed inadequate amounts of protein and energy for a lengthy time period. Stunting is reflected by poor growth in terms of height-for-age. It is one of three common anthropometric indicators of protein-energy undernutrition measured among children under the age of five (see Table 2.1).

The other two indicators of protein-energy undernutrition are wasting and underweight. Wasting is an indicator of acute undernutrition, measured by weight-for-height or by mid-upper arm circumference (MUAC). In severe cases, wasting can lead to marasmus, when children appear extremely thin or skeletal due to inadequate calorie intake. Severe acute undernutrition due to inadequate protein intake can cause kwashiorkor, when children appear bloated due to edema. Sometimes a severely acute undernourished child presents with marasmic-kwashiorkor, when the child is both wasted and has edema. Children who are underweight, measured by weight-for-age, can either be chronically or acutely undernourished.

A child is considered moderately undernourished when their measurements are between two and three standard deviations below the global median measurement. Children are considered severely undernourished if they are measured three or more standard deviations below the global median. The World Health Organization (WHO) provides guidance on these measurements and standards.²

1. Feed the Future, *Feed the Future Progress Report: Boosting Harvests, Fighting Poverty* (Washington, DC: U.S. Government, October 2012).

2. World Health Organization, *WHO Child Growth Standards* (Geneva: WHO, 2006).

Table 2.1. Indicators of Undernutrition

Indicator	Type of Undernutrition	Measurement
Stunting	Chronic	Height-for-Age
Wasting	Acute	Weight-for-Height or MUAC
Underweight	Chronic and Acute	Weight-for-Age

consume eggs daily. In a case from Bangladesh, households that participated in a homestead poultry and egg program ate more eggs and chicken than before the program.²²

Poultry ownership can also increase income. A different assessment of a homestead chicken and egg production program in Bangladesh found that, although both program participants and a comparison group consumed similar amounts of poultry products, participating households sold more poultry products.²³ When households sell poultry products, they can then purchase other food to complement their diets. In Bangladesh, households that participated in the homestead poultry and egg program consumed more fish than a comparison group,²⁴ suggesting that targeted households both consumed and sold chicken products, using the proceeds to purchase additional complementary foods. Income from poultry also pays for nonfood needs, such as school fees, medicine, and hygiene materials, which may also contribute to better nutrition. In much of Africa, poultry production is one of the few and first mechanisms for poor households to accumulate assets.²⁵ Poultry keepers can manage production flows to meet small and immediate expenses, avoiding the sale of larger assets such as cattle.²⁶ As one focus group of farmers in Ethiopia explained, poultry keeping “is the first step on the ladder for poor households to climb out of poverty.”²⁷

Unfortunately, although households owning poultry eat a more diverse diet, owning poultry does not necessarily correspond with improvements in measures of stunting or wasting.²⁸ Further study is necessary to determine if there is a link between poultry ownership and measures of undernutrition.

Small Ruminants

Small ruminants, such as goats or sheep, yield many food products, including milk, meat, offal, and blood. Goat and sheep reproductive cycles take a minimum of one year for gestation, weaning, and finishing before a new goat or sheep is large enough for slaughter. It may be several more years before a household is willing to cash out on an animal.

Female goats and ewes can be milked frequently during weaning. Although goat and ewe dairy consumption could occur daily, small ruminant ownership does not strongly predict frequency of dairy consumption. This may be because drinking goat and ewe milk is associated with being in a lower socioeconomic class in many societies. For this reason, men may avoid being associated with owning goats and sheep, and women are more often the ones to care for small ruminants. Aversion to goat and ewe milk is not universal, however. Pastoralist women in Ethiopia say that

22. Dolberg, “A Livestock Development Approach.”

23. Hanne Nielsen, Nanna Roose, and Shakuntala H. Thilsted, “The Impact of Semi-Scavenging Poultry Production on the Consumption of Animal Source Foods by Women and Girls in Bangladesh,” *Journal of Nutrition* 133 (2003): 4027S–4030S.

24. Ibid.

25. Lora Iannotti et al., “Eggs: The Uncracked Potential for Improving Maternal and Young Child Nutrition among the World’s Poor,” *Nutrition Reviews* 72, no. 6 (2014): 355–368.

26. H. A. Aklilu et al., “How Resource Poor Households Value and Access Poultry: Village Poultry Keeping in Tigray, Ethiopia,” *Agricultural Systems* 96, no. 1–3 (2008): 175–183.

27. Ibid.

28. Nielsen, Roose, and Thilsted, “The Impact of Semi-Scavenging Poultry Production.”

goat milk is tastier than cow milk.²⁹ Goat milk is also richer in vitamin A than cow milk.³⁰ In many pastoralist societies, goats and sheep are kept to complement larger animals to ensure a consistent supply of milk for children during dry seasons when larger animals may be unable to be milked or are taken far away from households for grazing.³¹

Although statistical evidence between goat and ewe ownership and dairy consumption is scant, there is evidence that goat ownership correlates with greater meat consumption. One study of a meat goat donation project in Rwanda found that *monthly* meat consumption was higher for households that received goats than those that did not.³² Goat ownership does not necessarily increase *daily* consumption of meat because in many livestock systems animals are only slaughtered when they become sick or unproductive or for special occasions.³³ Likewise, sheep are often slaughtered exclusively for religious holidays.

The evidence that small ruminant ownership improves nutrition outcomes is mixed. Owning goats and sheep is associated with a better nutritional status for older children (24 to 59 months) in terms of measures of both wasting and underweight, but there is no relationship between owning small ruminants and the nutritional status of younger children (6 to 23 months), according to a study from Uganda.³⁴ The same study found no relationship between owning small ruminants and stunting.³⁵ Likewise, participants in a meat goat donation program in Rwanda also had lower likelihood of wasting and underweight than a comparison group, but there was no relationship between receiving a goat and measures of stunting.³⁶ Overall, research suggests that there is little relationship between owning small ruminants and levels of stunting.

Large Ruminants

Large ruminants provide many food products, such as milk, meat, offal, and blood. Their larger size adds the provision of soil tillage and transportation services to the advantages of large ruminants. Although this section focuses on cattle, other types of large ruminants are popular in different parts of the world. Domestic water buffalo, for example, are used for tillage purposes in South and Southeast Asia, in addition to being a source of milk. Yaks are popular in Central Asia for dairy, meat, and wool products as well as for transportation (Box 2.4 discusses additional livestock diversity).

Gestation for cattle is typically nine months, and it takes several years before a calf is mature enough for slaughter, depending on whether it is fed grain or grass or a combination of the two, including animal feed made from stover, molasses, and other ingredients. Households with small herds will not slaughter cattle frequently due to long gestation and development periods. Families

29. Sadler and Catley, *Milk Matters: The Role and Value of Milk*.

30. Benoît Graulet, "Ruminant Milk: A Source of Vitamins in Human Nutrition," *Animal Frontiers* 4, no. 2 (April 2014): 24–30.

31. Sadler et al., *Milk Matters: A Literature Review*.

32. Rawlins et al., "Got Milk?"

33. Randolph et al., "Invited Review."

34. Azzarri et al., "Does Livestock Ownership Affect Animal Source Foods Consumption and Child Nutritional Status?"

35. Ibid.

36. Rawlins et al., "Got Milk?"

BOX 2.4. Other Livestock: Camels, Pigs, and Rabbits

There are many of other types of livestock, such as camels, pigs, and rabbits, which also contribute to the livelihoods and diets of poor, rural households.

Camels, for example, are an important source of milk, and sometimes meat, in parts of North and East Africa and Western Asia. In Isiolo County, Kenya, camel milk and meat is a significant and substantial part of the diets and incomes of pastoralists.¹ Camel milk is also popular among some pastoralist groups in Ethiopia, where it is perceived to be good for children's digestion and overall health.² But the benefit of camel ownership is not equal among poor and wealthy households; more affluent families in Ethiopia tend to own more camels and to consume more camel milk than poorer families.³ Production and marketing of camel milk is expanding in the drylands of Ethiopia and northern Kenya, even in households that own few milking camels. Camels and similar species, such as llamas and alpaca, are also used for transportation for individual riders, to load with goods or to pull carriages.

Rabbits and pigs are popular in poor, rural households because they require relatively fewer inputs than larger animals and can reproduce quickly. Similar to goats and poultry, pigs and rabbits can be sold to cover smaller unexpected household expenses or used for household consumption more regularly than larger animals that take longer to reproduce. Smaller livestock are also considered suitable for women and youth to manage in many cultures. Pig ownership may protect households from shocks in other ways as well: in Karamoja, Uganda, raising pigs is becoming more popular because pigs are less likely targeted for theft than cattle.⁴ Both pigs and rabbits are also suitable for more densely populated communities because they require little land, as compared to ruminants.

1. Yazan Ahmed Elhadi, Dickson M. Nyariki, and Oliver V. Wasonga, "Role of Camel Milk in Pastoral Livelihoods in Kenya: Contribution to Household Diet and Income," *Pastoralism* 5, no. 1 (2015): 8.

2. Sadler and Catley, *Milk Matters: The Role and Value of Milk*.

3. Galma Wako, *Economic Value of Camel Milk in Pastoralist Communities in Findings from Yabello District, Borana Zone*, IIED Country Report (London: International Institute for Environment and Development, April 2015).

4. Levine, "What to Do about Karamoja?"

with larger herds, however, can off-take more regularly without compromising herd size. The number of cattle owned in Uganda, for example, is correlated with greater consumption of beef and dairy products.³⁷

Poorer households often do not own enough cattle to sustain regular off-take. For this reason, milk is the primary ASF produced by poor cattle owners. Cows can be milked regularly—both in the mornings and in the evenings—when lactating. The amount of milk produced varies widely depending on the breed (indigenous breeds of cows produce less milk than European breeds), the quality of animal feed for cows, and the availability of water. There is ample evidence that cow ownership contributes to more dairy consumption. Data from Ethiopia, Uganda, Kenya, and Rwanda showed that cow-owning households consume more dairy products than comparable

37. Azzarri et al., "Does Livestock Ownership Affect Animal Source Foods Consumption and Child Nutritional Status?"

households that do not own cows.³⁸ For example, owning a cow in Ethiopia increases the likelihood that milk was consumed during a seven-day dietary recall by 22.5 percentage points.³⁹

In addition to consuming milk at home, households can also sell milk on a daily basis, thereby earning a daily income. These sales can substantially increase the incomes of the poor. In Ethiopia, for example, households that participated in a market-oriented dairy project had incomes that were 72 percent higher than households that were not involved in the project.⁴⁰ Similar evidence was also found in studies conducted in India and Kenya.⁴¹ When cattle are slaughtered, it is unlikely that a single family will consume an entire animal. For this reason, wealthier cattle owners, whose herd size is large enough to support sustainable off-take, may also sell cattle for income.

There is also substantial evidence that cow ownership improves nutrition. Owning even a single cow reduced the probability of stunting by 5.5 percentage points for children between 6 and 24 months.⁴² According to another study in Kenya, if all households owned at least the average number of cows in the study area (1.69 cows per household), the percent of stunted children would decrease from 53 percent to 32 percent.⁴³ Following a cow donation program in Rwanda, children in households that received dairy cows had lower levels of stunting than similarly qualified households that did not receive cows.⁴⁴ The evidence, however, is not unanimous. Another study in Uganda found that, while ownership of cattle may increase consumption of related ASFs and reduce the prevalence of underweight, stunting is not affected.⁴⁵

Overall, types of livestock that produce ASFs on a regular basis have a greater potential to help poor livestock keepers increase income and consume more nutritious diets. Smaller livestock that can regularly be slaughtered, such as chickens, are also likely to provide nutrition and food security benefits to poor families, though less regularly. Although the evidence of whether this results in changes in measures of stunting is varied, it is clear that owning certain types of livestock can improve nutrition outcomes. Of course, the way in which programs are designed and implemented impacts the efficacy of livestock programs in achieving nutrition goals, as Chapter 5 explains.

38. Ibid.; Charles F. Nicholson et al., "Dairy Cow Ownership and Child Nutritional Status in Kenya" (presentation, American Agricultural Economics Association, annual meeting, Montreal, Canada, July 27–30, 2003); Hoddinott, Headey, and Dereje, "Cows, Missing Milk Markets, and Nutrition in Rural Ethiopia"; Hoorweg, Leegwater, and Vererman, "Nutrition in Agricultural Development"; Rawlins et al., "Got Milk?"

39. Hoddinott, Headey, and Dereje, "Cows, Missing Milk Markets, and Nutrition in Rural Ethiopia."

40. Jef L. Leroy and Edward A. Frongillo, "Can Interventions to Promote Animal Production Ameliorate Undernutrition?," *Journal of Nutrition* 137, no. 10 (2007): 2311–2316.

41. Ibid.

42. Hoddinott, Headey, and Dereje, "Cows, Missing Milk Markets, and Nutrition in Rural Ethiopia."

43. Nicholson et al., "Dairy Cow Ownership and Child Nutritional Status in Kenya."

44. Rawlins et al., "Got Milk?"

45. Azzarri et al., "Does Livestock Ownership Affect Animal Source Foods Consumption and Child Nutritional Status?"

Feed the Future, Livestock, and Nutrition

FEED THE FUTURE: THE OBAMA ADMINISTRATION'S ANSWER TO GLOBAL HUNGER

Launched early in the Obama administration, the Global Hunger and Food Security Initiative, now called Feed the Future, promised to tackle global hunger through a \$3.5 billion commitment announced at the 2009 L'Aquila G8 Summit. The pledge closely tracked the Rome Principles for Sustainable Global Food Security.¹ Core to the approach of Feed the Future was support for national efforts to combat malnutrition in the 19 target countries. Feed the Future aims to address global hunger by promoting both agricultural growth and better nutrition while reducing poverty and chronic undernutrition by 20 percent each. The joint effort required breaking down institutional silos both within and outside of the United States Agency for International Development (USAID), for example. Within USAID, the Economic Growth and the Global Health offices at the field level, for example, needed to collaborate more closely. Beyond USAID, 10 other U.S. agencies contribute to Feed the Future, including the United States Department of Agriculture, the Millennium Challenge Corporation, and the Peace Corps. USAID's Multi-Sectoral Nutrition Strategy reiterates the whole-of-government approach promoted by Feed the Future, emphasizing the need for coordinating strategies and plans across these agencies and for U.S. government assistance to integrate nutrition within their programming.²

In practice, as Feed the Future strategies were drawn up in collaboration with U.S. government missions in the 19 target countries, there was a strong emphasis on building value chains for crops. While some country strategies explicitly aimed to affect nutrition, the goals of many Feed the Future strategies focus on economic growth through linking smallholders to markets for key agricultural commodities. USAID missions were encouraged to limit the number of value chains

1. Marian L. Lawson, Randy Schnepf, and Nicolas Cook, *The Obama Administration's Feed the Future Initiative* (Washington, DC: Congressional Research Service, 2016), <https://www.fas.org/sgp/crs/row/R44216.pdf>.

2. USAID, *Multi-Sectoral Nutrition Strategy: 2014–2025* (Washington, DC: USAID, 2014).

supported with Feed the Future funds. The assumption was that concentrated value chain development efforts would inevitably have greater impact and reduce poverty. Unfortunately, many of the initial value chain–focused programs did not address nutrition, and market activity does not necessarily result in better nutrition at the household level. Only in the last few years did USAID begin to emphasize the importance of nutrition sensitivity within Feed the Future programs.

Feed the Future programs are primarily managed through the Economic Growth offices of USAID at the mission level, with other agencies and funding streams complementing the overarching strategy. For example, nutrition-related strategies and goals in Feed the Future country strategies are mainly supported through a different Obama administration endeavor, the Global Health Initiative, funds for which flow through the Global Health office. The bifurcation created by having nutrition supported by the Global Health offices and agriculture by the Economic Growth offices means that, in some cases, the collaborative and integrated approach to tackling hunger is not always realized. The locus of responsibility for achieving Feed the Future’s nutrition goals remains unclear.

LIVESTOCK PROGRAMS IN FEED THE FUTURE

As with crop-based Feed the Future strategies, those related to livestock often focused on developing value chains for specific animal-sourced foods. Investments in value chains for live animals and meats were identified in Ethiopia, Kenya, Liberia, and Mali’s Feed the Future country strategies. Dairy value chains were prioritized in Ethiopia, Kenya, Malawi, and Rwanda, and more recently in Bangladesh. Strategies for Nepal and Tajikistan also identified livestock as a potential area of intervention, but Feed the Future programs in these countries have not funded livestock interventions as of yet. Livestock programs in Feed the Future rarely incorporate a nutrition strategy, with the exception of a new program in Bangladesh. A brief overview of the projects is included in Appendix 1. In addition, two innovation labs on livestock were created (see Appendix 2).

A deeper analysis of one Feed the Future livestock program, a dairy value chain project in Rwanda, furnishes a case study to examine potential livestock activity contributions to Feed the Future stunting reduction targets.

Livestock programs in Feed the Future rarely include a nutrition-related strategy.

Case Study: Dairy Sector Development in Rwanda

Bolstered by a cultural and national policy foundation that supports dairy cow ownership and milk consumption, the Rwanda Dairy Competitiveness Program II (RDCP-II, 2012–2017), funded by USAID/Rwanda and implemented by Land O’Lakes International Development (Land O’Lakes), demonstrates how a Feed the Future program focused on the value chain for animal sourced-foods worked to reduce undernutrition. Unless otherwise noted, the information in this case study is based on interviews, focus group discussions, and observations made during a two-week re-search trip to Rwanda in July 2016.

LIVESTOCK, DAIRY, AND MALNUTRITION IN RWANDA

More than two decades after a horrific genocide in Rwanda when up to one million people were killed in a period of 100 days, the small, landlocked country in East Africa is determined to grow despite its devastating past. This sense of collective responsibility for the betterment of the country is apparent when chatting with Rwandans. “Because of our history” is a common response when asked why they are so determined to do better or follow the advice of their government. As part of recovery and reconciliation, the practice of Umuganda, or “coming together to achieve a common purpose,” was instituted. Though Umuganda, Rwandans join together once a month to discuss community problems and to conduct community service projects—cleaning the streets, improving infrastructure, building schools, and engaging in other communal activities. Rwandans across the socioeconomic spectrum speak proudly of their personal or household progress and their goals for future improvement. This commitment to development is also visible. Known as the land of 1,000 hills, the Rwandan countryside is remarkably green and free of litter. Kigali, the capital, is a clean, orderly, and bustling city that radiates resolve.

Rwanda is not immune to development challenges, such as poverty and undernutrition. Levels of chronic malnutrition (measured through stunting of children under five years old) have decreased substantially—from 51 percent of children under five years of age in 2005, to 44 percent in 2010, to

38 percent in 2015.¹ However, this improvement masks a troubling divide between children in urban and rural settings, as well as between poor and wealthier households. In rural areas, 41 percent of children are stunted, as compared to 24 percent in urban areas.² Rural areas also tend to exhibit deeper poverty. As of 2014, 40 percent of Rwandans lived below the national poverty line and 16 percent lived in extreme poverty.³ Chronic poverty translates into chronic undernutrition: children from households in the lowest wealth quintile are more than twice as likely to be stunted as children from the highest wealth quintile (49 percent and 21 percent, respectively).⁴

One strategy promoted by the government of Rwanda to tackle undernutrition is a series of state-sponsored dairy-related programs.⁵ They include a program that distributes dairy cows to poor families (One Cow per Poor Family, or “Girinka”), the promotion of children’s milk consumption (One Cup of Milk per Child), a school-feeding program that features milk (Home Grown School Feeding), and the distribution of milk for malnourished younger children at health centers. Launched in 2006, the One Cow per Poor Family program distributes dairy cows to impoverished families who are capable of caring for a cow. Criteria for participation in this program include having land to grow fodder and an appropriate shelter for the cow. As a result, households receiving cows through the One Cow per Poor Family program are unlikely to be the poorest of the poor. The first offspring from the transferred cows are supposed to be redistributed to other poor families. With the support of international nongovernmental organizations, such as Send a Cow and Heifer International, the program has distributed 230,000 dairy cows between 2006 and 2015⁶ and aims to distribute a total of 350,000 by 2017.⁷ Efforts to promote milk consumption to combat malnutrition are reaching even the most destitute of Rwandan society: rural health clinics provide milk to parents who often cannot afford to purchase milk themselves and whose children are malnourished. Through dairy and other types of programs, the Rwandan government aims to reduce the prevalence of stunting to 18 percent by 2018.⁸

Cattle ownership and milk consumption are deeply rooted in Rwandan culture. Nearly one-third of Rwandans owned cows as of 2012.⁹ Historically, as in much of East Africa, cattle ownership in

1. National Institute of Statistics of Rwanda (NISR), Ministry of Health (MoH) [Rwanda], and ICF International, *Rwanda Demographic and Health Survey 2014–15* (Rockville, MD: NISR, MoH, and ICF International, 2015).

2. Ibid.

3. NISR, *Rwanda Poverty Profile Report, 2013/2014*, August 2015.

4. NISR, MoH, and ICF International, *Rwanda Demographic and Health Survey 2014–15*.

5. Ministry of Agriculture and Animal Resources (MINAGRI), *Programs to Combat Malnutrition in Rwanda Yield Positive Results—2015 CFSVA Report*, http://www.minagri.gov.rw/index.php?id=469&tx_ttnews%5Btt_news%5D=1266&cHash=56f2a93119aaef3990585677addd605f.

6. Ibid.

7. MINAGRI, *One Cow per Poor Family Pro-Gram “Girinka,”* accessed November 11, 2016, <http://www.minagri.gov.rw/index.php?id=28>.

8. MINAGRI, *Programs to Combat Malnutrition in Rwanda Yield Positive Results—2015 CFSVA Report*.

9. NISR and Ministry of Finance and Economic Planning (MINECOFIN) [Rwanda], *Rwanda Fourth Population and Housing Census. Thematic Report: Characteristics of Households and Housing, 2012*, http://www.lmis.gov.rw/scripts/publication/reports/Fourth%20Rwanda%20Population%20and%20Housing%20Census_Housing.pdf.

Rwanda was a sign of wealth and status that sometimes fell along ethnic lines: Tutsis were more likely to own larger quantities of cattle than Hutus (Belgian colonists identified Tutsis as those that owned 10 or more cows).¹⁰ After independence, scarce access to land for Hutu farmers and Tutsi pastoralists further contributed to ethnic divisions as the population grew. Tensions between Hutus and Tutsis, which culminated in the 1994 genocide, also contributed to a significant loss of the nation's livestock. It is estimated that 80 percent of Rwanda's cattle were lost, in addition to 90 percent of small ruminants and 95 percent of poultry in the early and mid-1990s.¹¹ The One Cow per Poor Family program seeks, in part, to reconstitute Rwanda's livestock assets, to remove ethnic divisions in cattle ownership, and to rebuild traditional collaboration between ethnic groups by promoting the sharing of milk between families.

In the years after the genocide, millions of people who fled from ethnic fighting returned. This put significant pressure on already densely populated land. To accommodate returnees, in the mid-2000s, the Rwandan government instituted a series of policies to redistribute land. Land-rich households were obliged to relinquish their holdings to landless returnees. By 2014, the average smallholder farm size in Rwanda was only 0.59 hectares per household.¹²

In effect, the policy of redistribution forced cattle ranchers to abandon their ownership of large herds of the prized indigenous long-horned Ankole cows, which relied on extensive rangelands, in exchange for smaller numbers of more economically productive dairy cows. Holstein Friesian and Jersey breeds, promoted through the One Cow per Poor Family and other dairy cattle improvement programs, produce more milk than the indigenous Ankole. Native Ankole cows have been artificially inseminated with select dairy breeds to produce a hearty crossbred milking cow adapted to local conditions, especially in the Eastern Province bordering Tanzania. In other regions, families received high-grade dairy heifers ready to calve and produce milk. Families receiving heifers and breeding services are encouraged to confine their cows in "zero-grazing" housing systems, where they are protected from disease-bearing ticks and other pests. Confined cows also expend less metabolic energy than those that are herded to far-off pasturelands. Forage for confined animals is produced on small plots or harvested from communal lands.

The government of Rwanda's vision for dairy sector development is detailed in its National Dairy Strategy of 2013.¹³ Rwanda has received substantial support from international donors to engage the rural poor with expanding market demand for milk. Support has been provided by USAID/Rwanda through the Rwanda Dairy Competitiveness Program, RDCP-I (2008–2011) and RDCP-II (2012–2017); the African Development Bank (AfDB) Dairy Cattle Development Support Project, PADEBL (1999–2009); and the Bill and Melinda Gates Foundation's East African Dairy Development Project, EADDP (2006–2010). These investments provided support to dairy producer cooperatives for the establishment and operation of Milk Collection Centers (MCCs), for farmer training on

10. Andrew Reid, "Cattle, Identity, and Genocide in the African Great Lakes Region," *Archaeology International* 4 (November 2000): 35.

11. M. L. Kane, M. Berekoutou, and L. Joottun, *Appraisal Report: Dairy Cattle Development Support Project, Republic of Rwanda*, African Development Fund, February 2000.

12. International Fund for Agricultural Development (IFAD), *Investing in Rural People in Rwanda* (Rome: IFAD, 2014).

13. MINAGRI, *National Dairy Strategy* (Kigali: Republic of Rwanda, 2013).

efficient production and safe handling of milk, and to collaborate with entrepreneurs for dairy processing innovations and market expansion. As a result of these efforts, some 100 MCCs, each capable of collecting and cooling between 2,500 and 5,000 liters of milk, dot the Rwandan landscape and provide a vital link between smallholder dairy farmers and milk traders and processors. Today, some of these MCCs are managed by dairy farm cooperatives and are involved in pasteurization.

A cultural inclination toward cow ownership and compliance with government instruction, donor support for milk marketing infrastructure, producer organization and training, land redistribution, and the One Cow per Poor Family policy created a fertile ground to grow the Rwandan dairy sector.

FEED THE FUTURE IN RWANDA

In early 2011, Feed the Future's Multi-Year Strategy for Rwanda (2011–2015) was released.¹⁴ Although there is some mention of health and nutrition-related issues, the proposed strategy focused on developing key food commodities (maize, beans, and milk) and export crops (coffee and pyrethrum—a type of flower used in the manufacture of insecticides). Strategies to achieve nutrition- and health-related objectives were not elaborated, except to broadly recommend complementing Rwanda's National Strategy to Eliminate Malnutrition by promoting health and social welfare and by supporting health service delivery.¹⁵ The absence of a plan to incorporate these components into a strategic path highlights how little of an emphasis Rwanda's Feed the Future strategy placed on reducing undernutrition. U.S. assistance for food security-related expenditures mirrors this imbalance: although the amount of aid spent on agriculture jumped from under \$10 million before 2009 to \$28 million in 2011, nutrition funds were less than 10 percent of that amount, at \$2.5 million (see Figure 4.1).

The strategy quickly honed in on value chains for beans, maize, and dairy, in addition to export crops such as coffee and pyrethrum. Value chains of focus were identified based on a set of criteria that included: (1) U.S. government experience in the value chain in Rwanda, (2) inclusion in either the government of Rwanda's Crop Intensification Program (CIP)¹⁶ or a list of identified exports in the Economic Development and Poverty Reduction Strategy (EDPRS), (3) the potential of the value chain to reduce poverty, and (4) the value of net exports. Although some figures in the strategy outline basic information on the nutritional value of the crops (which, naturally, does not include dairy), the potential for investment in any value chain to reduce malnutrition was not considered.

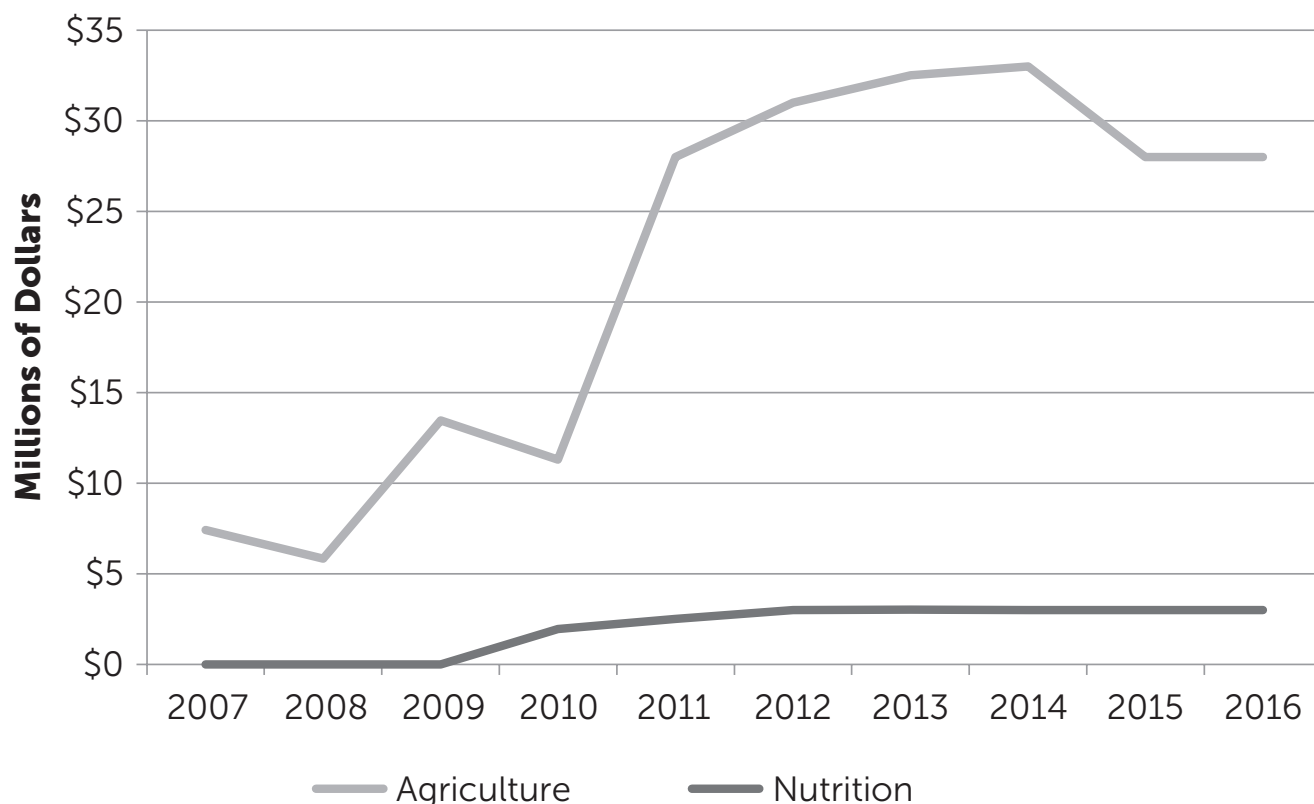
According to the Feed the Future/Rwanda Multi-Year Strategy, this preliminary value chain analysis did not identify dairy for investment concentration. Dairy failed almost every criterion that the strategy identified. First, it was not prioritized in the government of Rwanda's CIP. Second, the

14. Feed the Future, *RWANDA FY 2011–2015 Multi-Year Strategy* (Washington, DC: U.S. Government, 2011).

15. Ibid.

16. CIP is a component of the government of Rwanda's commitment to meet goals for investment in the agriculture sector under the Comprehensive Agreement for Agricultural Development Program (CAADP), an international agreement between member governments of the African Union and donors.

Figure 4.1. U.S. Food Security Assistance to Rwanda, 2007–2016



Source: foreignassistance.gov.

strategy estimated that growth in the dairy sector was unlikely to meaningfully reduce poverty. Third, a relatively small portion of Rwandan households were engaged in milk production. Finally, dairy products have a low potential export value. The only selection criteria in Rwanda's Feed the Future Multi-Year Strategy that dairy did meet was that the U.S. government had experience in the value chain. Because of U.S. experience in the Rwandan dairy sector, the government of Rwanda's commitment to the dairy sector via the One Cow per Poor Family program, and the growth in the

The only selection criteria in Rwanda's Feed the Future Multi-Year Strategy that dairy did meet was that the U.S. government had experience in the value chain.

dairy industry in the years preceding the strategy's development (mostly due to U.S. development assistance), dairy was nonetheless identified as an attractive value chain for investment.¹⁷

Four main programs were created out of the Multi-Year Strategy, funded and managed by USAID/Rwanda. One, the Rwanda Dairy Competitiveness Project II (RDCP-II), frames the Rwandan dairy sector as an opportunity to reduce poverty among smallholders through engagement in the country's growing market for milk and dairy products.

17. Feed the Future, *RWANDA FY 2011–2015 Multi-Year Strategy*.

The Rwanda Dairy Competitiveness Program II

RDCP-II, implemented by Land O'Lakes International Development (Land O'Lakes), is a five-year, \$15 million program designed to strengthen the market for safe dairy products in Rwanda between 2012 and 2017. Land O'Lakes built RDCP-II from the earlier Rwanda Dairy Competitiveness Program (RDCP, 2008–2011), which it implemented for three and a half years in two districts in the eastern province as well as in Kigali. In addition to building the capacity of poor dairy farmers to produce greater quantities of milk, this first incarnation of RDCP included a PEPFAR (President's Emergency Plan for AIDS Relief) component, which aimed to improve the nutritional status of people living with HIV and AIDS. With RDCP-II, however, the focus shifted to strengthening the supply and demand for safe dairy products all along the value chain, from producers to consumers.

From the project's early stages, Land O'Lakes recognized that RDCP-II's success hinged on better production and market linkages for safe Rwandan dairy products *as well as* increased demand for those products. Despite a history of milk consumption in Rwanda, dairy consumption before RDCP-II was remarkably low. In 2008, annual per capita milk consumption in Rwanda stood at 12 liters—far less than in neighboring Kenya or Uganda, where annual consumption was estimated at 100 and 22 liters, respectively.¹⁸ Roughly half of all milk made it to the market due to losses along the value chain, and 96 percent of milk in the market was unprocessed and low quality.¹⁹ RDCP-II's strategy reflected the need to develop markets with four different pillars of activities: increasing farm-level production, improving milk quality along the value chain, building an enabling policy environment for safe dairy, and increasing end-market demand for safe dairy products.

Increased Production

On the production side, Land O'Lakes worked closely with poor farmers to improve the productivity of dairy cows and the sanitary conditions under which milk is collected and transported to processors. Land O'Lakes provided training for RDCP-II farmers on cattle management and herd health (including livestock nutrition), dairy business management, milk quality and safe collection, cooperative development, and gender sensitization. Other efforts to increase milk production include artificial insemination services, with semen selected from high-producing U.S. dairy cows, and the distribution of fodder seed for farmers to grow crops that could be used to make more nutritious cow feed.

The results have been remarkable. On average, milk production at RDCP-II dairy farm households increased from 5.8 liters per day in 2013 to 19.4 liters per day in 2015. Adoption of best practices for sanitary collection and handling of milk from cow to milk cooling tank, milk quality testing, and improved transportation equipment (metal milk cans instead of plastic jerry cans) reduced the amount of milk rejected at MCCs according to both farmers and cooperatives.

Safe Dairy Market Integration

RDCP-II's efforts substantially increased the amount of raw milk produced by smallholders and sold into marketing channels that ended up in urban milk kiosks and processing plants. The

18. TechnoServe Rwanda, "The Dairy Value Chain in Rwanda," East Africa Dairy Development Program, October 2008.

19. Ibid.

success of Land O'Lakes in building the value chain is tangible, especially in urban markets. Inyange, the largest milk processor in Rwanda, reports that its production of pasteurized milk has increased from 25,000 liters per day to 100,000 liters per day, due to growing availability of safe, fresh milk coinciding with RDCP-II's implementation. Milk-vending kiosks franchised by Inyange, called "Milk Zones," are popping up across Kigali to sell bulk ultra-high-temperature pasteurized milk to urban consumers at half the price of packed milk. Rwandan dairy products that were previously absent in urban markets, such as yogurt and cheese, are now available in grocery stores and at restaurants. A growing amount of milk, mainly traditional fermented milk (*ikivugoto*), is now also sold across borders into the Democratic Republic of the Congo (DRC) and Burundi. The DRC is an important market for Rwanda's version of cheddar cheese.

Building a Better Enabling Environment

Land O'Lakes worked to develop market linkages between dairy producers and processors to complement the increase in the supply of safe dairy products. This includes the launch of the Seal of Quality, the first attempt to ensure a safe supply of milk from farmers to processors, and a joint initiative with Land O'Lakes and the Rwandan Ministry of Agriculture and Animal Resources (MINAGRI) to reward milk quality improvements. RDCP-II also worked with MINAGRI to develop a Ministerial Order, which was adopted in the fall of 2015, to establishment standards on the preservation, collection, transportation, and sale of milk. A Cheese and Dairy Expo for producers to showcase products has also been held annually since May 2014.

Driving Demand for Milk Consumption

In May 2014, Land O'Lakes, MINAGRI, and the Rwanda National Dairy Platform (RNDP) launched a campaign called Shisha Wumva ("Feed the Goodness") to promote milk consumption nationally. Using a mixture of TV, radio, and other media sources, the campaign encourages the consumption of safe Rwandan dairy products by touting the benefits of milk as part of the diet. Shisha Wumva is well known among households engaged by Land O'Lakes; by 2015, two-thirds of RDCP-II households had heard of Shisha Wumva (see Figure 4.2). Individuals from communities in which Land O'Lakes works are more likely to be familiar with Shisha Wumva than with the "Land O'Lakes" organization itself.

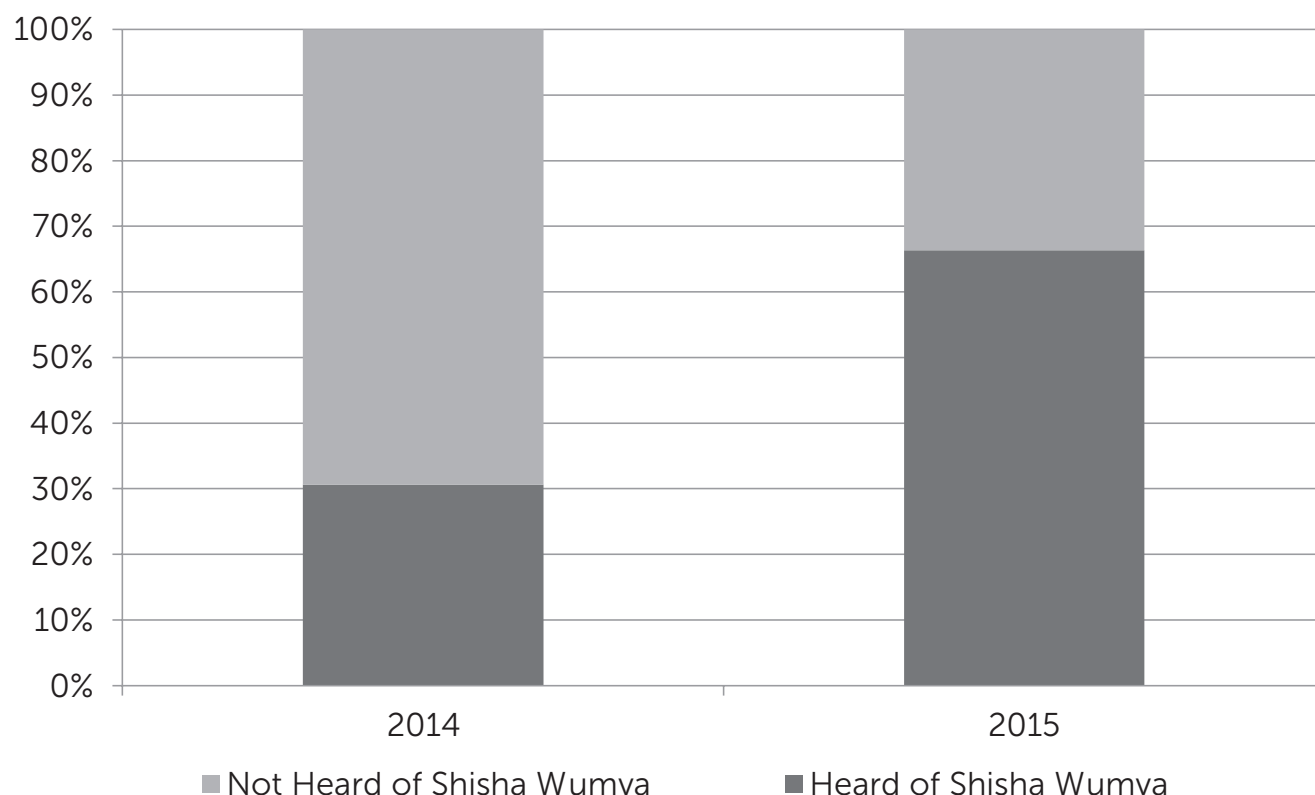
Some dairy cooperatives working with Land O'Lakes also promote milk consumption within their communities under the Shisha Wumva banner. A dairy cooperative in Ruhango serves milk at all of

Growing demand for milk products in urban markets creates an incentive for poor dairy-producing households to sell their milk rather than to consume it themselves.

its meetings, instead of the customary bottles of soft drinks, and even donates milk to acutely malnourished children that live nearby. The Ruhango cooperative is also processing and selling fresh and fermented milk locally. In Ngondore, a cooperative opened a "Milk Bar" across the street from their MCC, to promote milk consumption in their community, providing an alternative to traditional local bars that sell alcohol. Located adjacent to a busy asphalt road, the small kiosk sells cups of cooked milk and

milk-tea to people in transit, including those who transport milk to the collection center. These are just two examples of cooperatives that are working to help promote milk consumption in their

Figure 4.2. RDCP-II Household Awareness of Shisha Wumva, a National Milk Promotion Campaign by Land O' Lakes



Source: Developed from Land O'Lakes Rwanda's Annual Survey of RDCP-II Households.

communities; similar community-focused milk consumption initiatives were introduced to other cooperatives supported by RDCP-II. Yet, while these activities may have led to a positive perception of drinking milk, it is hard to measure whether they are leading to meaningful milk consumption.

There is a lack of rigorous evidence to measure whether Shisha Wumva awareness is sufficient to convince vulnerable households to purchase milk products promoted by the campaign. Pasteurized milk products are essentially financially inaccessible to the extremely poor, rural households that are most likely to have malnourished children in the first place. Even Inyange's Milk Zones, which provide bulk ultra-high-temperature pasteurized milk to urban consumers, sell milk at higher prices than those found in informal milk markets. A liter of pasteurized milk from a Milk Zone costs 500 Rwandan francs per liter, which is half the price of ultra-high-temperature pasteurized milk packed in expensive foil-lined boxes but still roughly twice as much as fresh unprocessed milk found in informal urban markets. In rural areas, poor households are encouraged to purchase milk from MCCs or associated cooperatives, but this too can be unaffordable for the extreme poor. The dairy cooperative in Ruhango sells milk at 300 francs per liter, for example. Although this milk is more affordable than most pasteurized milk sold in Rwanda, it is more expensive than raw milk in the informal market.

At the same time, growing demand for dairy products in urban markets creates an incentive for poor dairy-producing households to sell their milk rather than to consume it themselves or share

it with neighbors. Anecdotal evidence suggests that some households that normally reserved milk collected during the evenings for home consumption began selling the evening milk to MCCs that remained open later in the day. Higher prices also mean that the poorest segments of rural Rwandan society, including those that do not own cows, may still find it difficult to access milk.

A SHIFT TO INTEGRATE NUTRITION IN FEED THE FUTURE RWANDA AND RDCP-II

Shortly after Rwanda's Feed the Future strategy was revealed and projects, including RDCP-II, were under way, a new USAID Mission Director came in the summer of 2012. According to USAID representatives in Washington, DC, and Kigali, the new Mission Director quickly recognized a substantial gap in the Feed the Future strategy regarding nutrition and "really took it to heart." One representative from USAID/Rwanda observed that the incoming director believed that the lack of nutrition integration was "a mistake." The director did two things to rectify matters straight away. The first was to spearhead a process for USAID/Rwanda to identify the drivers of stunting in Rwanda so that any program design was based on context-specific evidence. The second was to create an internal nutrition working group to integrate and scale nutrition-related activities collaboratively. The group was headed by a Deputy Mission Director, with staff from the Economic Growth, Education, Global Health, and other technical offices.

Changing course when Feed the Future programs already were under way was a challenge, but the new approach was slowly embraced. To jump-start change, the USAID Mission Director organized a three-week workshop that brought together colleagues from Washington and Kigali from the Economic Growth, Global Health, Education, and Bureau for Food Security offices. The workshop's purpose was to identify potential areas where nutrition could be integrated into the existing strategy and programs, in addition to developing new programs that would more directly support nutrition. Rather than relying on remote communications between Kigali and Washington, customarily a slow process, key actors were able to collaboratively mold a new strategy to combat stunting in Rwanda together and in coordination with the government.

Feed the Future programming in Rwanda began to shift to more proactively address chronic undernutrition. One result of the workshop was the development of a nutrition coordination effort called the Community Health and Improved Nutrition (CHAIN) project, which began in the fall of 2014.²⁰ Although technically managed by the Global Health office, the CHAIN project brings Feed the Future activities funded through the Economic Growth office and other related activities under its umbrella. This is the first activity in USAID/Rwanda that attempts to officially coordinate across offices. CHAIN organizes implementing partners to share best practices, communicate on activities to avoid duplication, and identify success stories.

20. USAID Missions use the term "program" in reference to an entire portfolio, under which different "projects" are developed. CHAIN is one such project. Within each project, there are a number of different "activities." Under this terminology, RDCP-II is an activity under the CHAIN Project.

CHAIN identified RDCP-II for integration of nutrition-related activities through communications interventions aimed to change behavior. It was an attractive option for nutrition integration within the broader portfolio because the focal value chain is high in nutritional value (dairy) with growing urban demand.

With USAID/Rwanda's encouragement, Land O'Lakes developed a strategy to integrate nutrition in the fall of 2015, three years into the five-year activity. Without dedicated nutrition staff in Rwanda, Land O'Lakes relied on support from its headquarters in the United States to help shape a new strategy in partnership with the Rwandan team's gender specialist. With many activities within the primary value chain development strategy already well under way, it was neither feasible nor practical to overhaul the program completely. Instead, Land O'Lakes built nutrition messaging into planned activities and distributed posters and brochures with nutrition information at farmer trainings, district-level Joint Action Development Forums, and RDCP-II Open Day events in their communities. The nutrition messages adapted *Shisha Wumva* to resonate with a more rural audience, emphasizing the importance of retaining milk for home consumption despite the opening of new market opportunities; the benefit of milk as a complementary food for children older than six months, pregnant women, and breastfeeding mothers; and the advantage of both men and women sharing responsibility over labor, household management, and children's nutrition.

In addition to building nutrition messages into existing activities, with USAID/Rwanda concurrence, Land O'Lakes developed a new activity aimed at nutrition behavior change: integration of milk consumption messaging into the script of a highly popular national radio soap opera. Implemented by Urunana Radio, a development communications activity of Urunana Development Corporation, the radio program is likely the most effective way that the Land O'Lakes program and *Shisha Wumva* addressed undernutrition (see Box 4.1 for more on Urunana Radio Soap Opera). The radio program itself is remarkably well designed and delivered in a culturally appropriate manner. With funding from the RDCP-II, Urunana Radio brings messages about nutrition and milk consumption into the homes of rural Rwandans based on assessments their script-writing team undertakes. For instance, the primary challenge uncovered by their assessment process is that men are making the decision to bring all of their households' milk to the market, without consulting their wives. Working with the Ministry of Health, the Rwandan Agriculture Board, and Land O'Lakes, Urunana developed a three-pronged strategy to change this behavior.

The first prong to improve household financial management and nutrition practices is the soap opera itself, where milk consumption messages are embedded into the drama. In recent episodes of Urunana, a family scenario is depicted in which the husband sells all of the household's milk production despite the fact that his wife is pregnant and they have young children. The wife sneaks around the husband to try to keep some milk for herself and her children, which she hides at a neighbor's house. Ultimately, the husband finds out and chastises his wife, demanding that she pay for the milk she "stole." Neighbors then intervene and shame him because his children are visibly malnourished. In the end, the husband realizes his mistake and starts keeping milk at home for his family.

As a second strategic approach, the soap is accompanied by an additional "radio magazine," a weekly digest of the episodes where community members, experts, and government

BOX 4.1. Urunana Radio Soap Opera

The Urunana Radio Soap Opera began in Rwanda in 1998, with the support of Health Unlimited, a British nongovernmental organization (NGO), to promote better family planning practices and to curb the spread of HIV. Today, the Urunana Radio Soap Opera is operated by Urunana Development Communications, which is an independent and entirely Rwandan organization. Partnering with NGOs such as Land O'Lakes, Urunana interweaves public health messages through the stories of the soap opera's characters.

Although edutainment initiatives are a familiar approach to achieve behavior change, Urunana is unique among radio soap operas in the region because of its 18-year history. Urunana is an extremely popular program in Rwanda—it purports that 70 percent of the population regularly tunes into its soap.

Part of the reason for the program's success is that it goes to extraordinary measures to ensure that its stories accurately portray the lives of target audiences. It does this by surveying listeners to learn about the issues that affect them most and by embedding its storywriters in the households of average Rwandans to absorb daily life. The narratives developed mirror family dynamics, language use, and other local qualities, giving the program an authentic, real-life flavor. As a result, different segments of Rwandan society easily connect with the characters depicted in Urunana. Listeners of all ages and socioeconomic backgrounds have a favorite character, whose story they follow closely. Scriptwriters hope that as characters' behaviors change to manage challenging circumstances, their audience will follow suit and change their own behavior.

representatives comment on the underlying messages. Finally, Urunana furthers its reach by taking its message to communities with live reenactments of the story line with the soap's actors. With Land O'Lakes, Urunana conducted these theatrical events in eight of the 17 communities where Land O'Lakes operates, selected for their concerning levels of malnutrition. According to Urunana, the size of the crowd has been anywhere between 4,500 and 25,000 people, representing roughly 80 percent of the communities in which the live reenactments take place.

The reach of the program is impressive: rural Rwandans are intimately familiar with Urunana and can repeat the recent story line on milk. This includes many listeners who are unaware of the Shisha Wumva campaign or the work of Land O'Lakes. Across Rwanda, when individuals are asked if they listen to Urunana, most say they do—including men, women, boys, and girls of all ages. At a health clinic in the Mukarange sector of Kayonza district, a group of 20 or so rural Rwandans was observed waiting to renew their medical insurance. When asked by the clinic's head nutritionist if they listened to Urunana, three-quarters of the group answered positively. A few individuals in the group recalled a recent story line about milk and could repeat the soap's story for the others. When the nutritionist asked if they agreed with the message, the group chuckled and said that they did. It is important to remember, however, that the campaign focused mainly on addressing behavior change within households that own dairy cows. Messages targeted to these individuals do promote milk sharing with neighbors who do not own cows but, without evaluation data, it is impossible to determine how the program affected extremely poor households who do not own cows and may not even have access to radios.

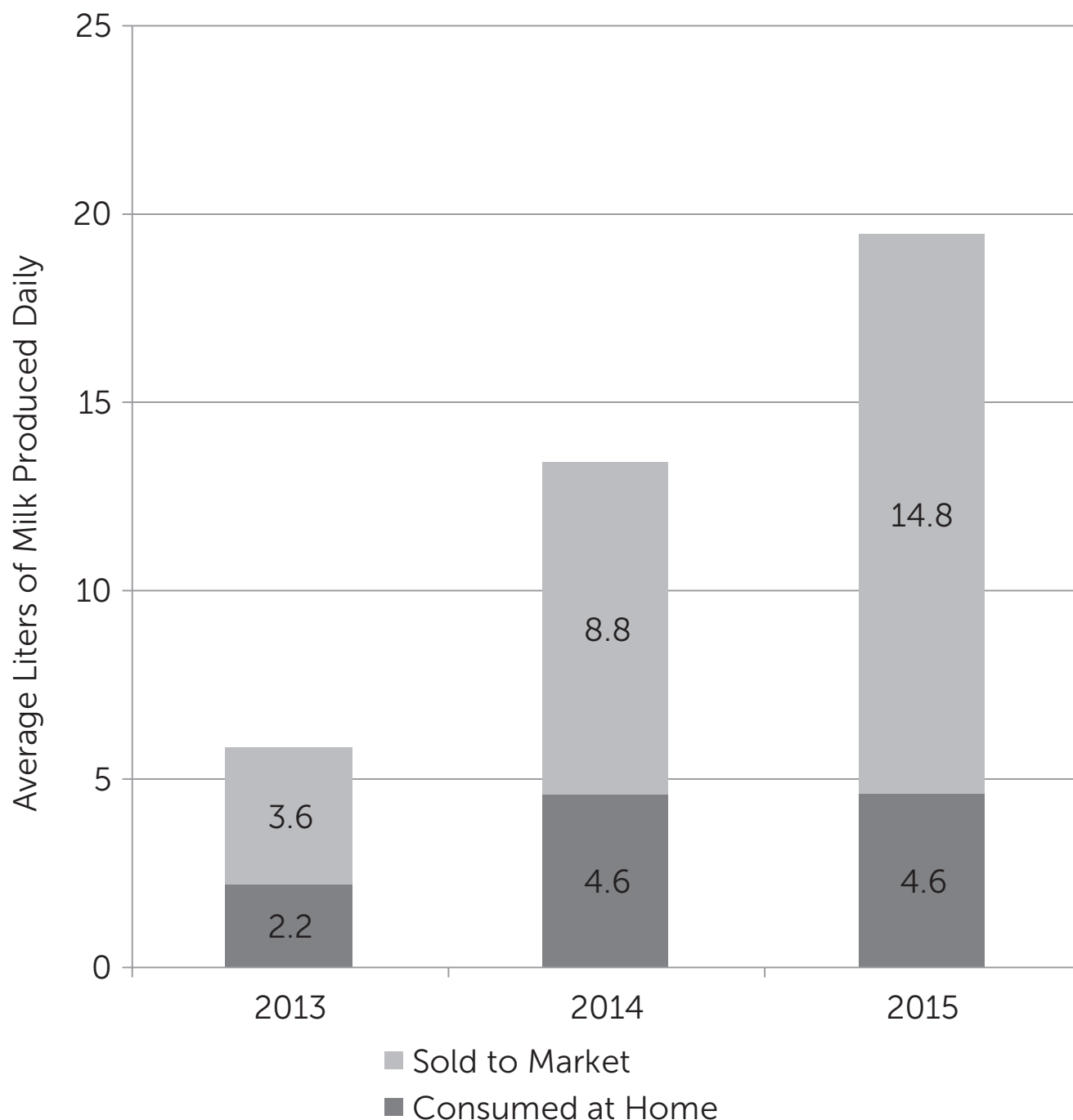
While we cannot know whether the soap opera has changed household practices regarding milk consumption and sales, Urunana believes it is making an impact. Feedback from listeners of the program suggests that the message was received and that practices are beginning to change. USAID representatives in Kigali indicate that they are pleased with the Shisha Wumva and Urunana behavior change campaigns and expressed regret that these initiatives began so late in RDCP-II's implementation period.

RDCP-II'S POTENTIAL IMPACT ON NUTRITION

Although RDCP-II was not originally designed to so improve nutrition, the program's efforts to reduce poverty and increase milk production and consumption may have driven nutrition gains in Rwanda. RDCP-II's original design did not necessitate nutrition indicators to be monitored or evaluated. As a result, no nutritional status baseline was established at the initiation of the activity in 2012, and information on the levels of stunting in RDCP-II households has not been collected. The only data on stunting levels come from the Rwandan government's regular Demographic and Health Survey (DHS), which indicate that stunting is on a downward trajectory. Information on dietary diversity was collected during the RDCP-II baseline and will be remeasured in RDCP-II's final annual survey. Since an end evaluation was not part of the original project budget, conducting one would require additional funding from USAID/Rwanda, which is not forthcoming (competing priorities are detailed in the next section of this chapter). Given that no final evaluations will be conducted, program impacts on either poverty or nutrition will go unmeasured. There is anecdotal evidence that the program is having a positive impact on poverty reduction in RDCP-II households and on milk consumption in the rural communities that RDCP-II targets. Dairy producers involved in RDCP-II explain that the program significantly improved their economic circumstances. These households report that before working with Land O'Lakes, production levels were too low to provide for both milk sales and home consumption. As the production levels of their cows increased, households were able to both consume and sell more milk. While the average quantity of milk kept for home consumption doubled among farm households (from 2.2 liters per day to 4.6 liters per day), even greater portions of milk are being sold according to annual surveys (see Figure 4.3). It is still too soon to tell if the more recent behavior change activities (e.g., Urunana's soap opera) have increased home milk consumption even more.

The rise of milk production meant that some RDCP-II farm households were also able to share milk with neighbors who do not own cows and whose children were malnourished. For example, one of RDCP-II's model farmers noticed that the children of his neighbor were acutely malnourished. The color of the second child's hair was turning a lighter color, a symptom of kwashiorkor (a form of acute undernutrition resulting from dietary protein deficiency), and the child was evidently ill. Because the farmer's cows were producing more milk (from around 5 liters per day prior to RDCP-II to around 20 liters per day now), he decided to share a liter of milk each day with the neighbor's children. Sharing milk was historically part of Rwandan culture, but the practice has fallen off in recent years following the country's tragic past. Government officials in the nearby

Figure 4.3. Daily Milk Consumption and Sales by RDCP-II Households



Burega sector of Rulindo district explain that they are encouraging community members to practice milk sharing again and that people are listening. Milk sharing, however, is unlikely to be a sustainable method of increasing milk access for extremely poor families. There is also a danger of milk that fails to meet quality hygienic standards imposed by MCCs returning to villages where it is shared with neighbors.

As a whole, children's milk consumption is increasing in Rwanda. The 2010 Rwandan DHS reported that 17 percent of children between 6 and 23 months old that were still breastfeeding

consumed milk in a 24-hour dietary recall.²¹ Five years later, this figure increased to 21 percent of breastfeeding children 6 to 23 months old.²² It is difficult to tell if the children who are now consuming milk were chronically undernourished in the first place, clouding the relationship between milk consumption and reductions in chronic undernutrition.

Increased income from greater quantities of milk sales also positively affects nutrition in RDCP-II households. Several households volunteered that before the program they were only able to eat one meal per day, but now, because of the proceeds of their growing milk sales, they eat three meals per day. Households that previously only consumed foods that they produced on their small homesteads report they are now using their milk proceeds to buy complementary food items, increasing the diversity of their diets on top of regular milk consumption. Consuming greater quantities of more diverse foods can improve children's growth and development.

Better income also helps improve living conditions, which could improve nutrition outcomes indirectly. RDCP-II households are investing in better home infrastructure, such as water taps and improved toilet facilities, with the income from their dairy cows. One RDCP-II beneficiary is a disabled single mother caring for four orphaned children as well as two of her own. After undergoing training with RDCP-II, she increased milk production from a cow she received from Send a Cow, enabling her to save money from milk sales to construct a better quality house, which included a water tap and new latrines. These created improved sanitary conditions within her home. As she explained, "Having a cow is like a factory, where I can get everything I need. It is medical insurance, school fees, and milk for drinking at home." Reducing chronic undernutrition in Rwanda may hinge on poverty reduction; as the nutritionist at the Mukarange health clinic explained, "People here know what to do [for better nutrition]. If you teach them, they understand, but they don't have the means."

"Having a cow is like a factory, where I can get everything I need. It is medical insurance, school fees, and milk for drinking at home."

In sum, it is difficult to assess scientifically and quantitatively the full impact of the RDCP-II activity on nutrition in beneficiary households. The lack of focus on nutrition from the start of the program meant that monitoring and evaluation systems were not developed to track progress on nutrition. Nonetheless, there is some anecdotal evidence that households in the RDCP-II program are consuming more milk and are better able to feed their families due to higher incomes from milk production and sales. However, RDCP-II targeted households that were a step or two above the extreme poor, because extremely poor households do not have the resources to own a cow. Households in extreme poverty are classified as such for many reasons, including having undernourished children. This implies that there is a critical gap in USAID/Rwanda's focus on dairy for reducing chronic undernutrition, because the type of livestock it focuses on (dairy cows) inadvertently excludes households that are extremely poor and more likely to have children that are

21. National Institute of Statistics of Rwanda (NISR), Ministry of Health (MoH) [Rwanda], and ICF International, *Rwanda Demographic and Health Survey 2010* (Calverton, MD: NISR, MoH, and ICF International, 2012).

22. NISR, MoH (Rwanda), and ICF International, *Rwanda Demographic and Health Survey 2014–15*.

chronically undernourished. As such, it is unclear if or how the program impacted nutrition for those that are the worst off.

THE FUTURE OF FEED THE FUTURE IN RWANDA

In addition to adapting existing value chain programs to incorporate nutrition-related activities, USAID/Rwanda is working to integrate nutrition into its future programming more fully. The

The relevance of livestock to achieving Feed the Future goals for chronic undernutrition may hinge on whether behavior change elements are reinforced in livestock-related programs.

coordination function of the CHAIN Project, incorporating a range of nutrition-sensitive and nutrition-specific activities led by a cross-office project management team, is one example of how this will be done moving forward. Several new projects that more fully embrace a nutrition-sensitive approach to developing value chains are also planned or under way. For example, two new projects were recently launched to promote value chains for nutrient-dense, iron-fortified beans and orange-fleshed sweet potatoes. Another program will focus on water,

sanitation, and hygiene in combination with nutrition.

A new program that will continue to support livestock as a pathway to better nutrition is also under development. It is possible that the activity will focus on smaller livestock such as goats or poultry. This potential shift could stem from two factors. First, the International Fund for Agricultural Development (IFAD) plans on investing a \$67 million loan for the Rwandan dairy sector over the next several years, which means that USAID will now pivot limited Feed the Future funds to other agricultural sector investments. Second, USAID/Rwanda's analysis of undernutrition drivers identified a potential focus on small livestock. Should the new program focus on smaller livestock and activities that are more appropriate for the poorest of the poor (who bear a disproportionate burden of undernutrition), it will address a somewhat glaring beneficiary targeting gap in the current strategic focus.

Feed the Future in Rwanda began with a strategy targeting the development of promising food and export crop value chains. After an intense process to shift the direction of the program to focus on nutrition, the strategy's market-level efforts have become more nutrition-sensitive. The mission, through the CHAIN Project, is now building out components that aim to change nutrition-related behavior at the household level. The relevance of livestock to achieving Feed the Future goals for chronic undernutrition may hinge on whether behavior change elements are reinforced in future livestock-related programs.

Constraints and Opportunities

Both the academic literature and the case study of the Rwandan dairy sector development through Feed the Future suggest that, while owning livestock can improve dietary intake and nutrition, there are several important factors that will influence the likelihood of this occurring. These factors include household, sociocultural, economic, political, and environmental conditions. Simply increasing ownership and productivity of livestock does not necessarily result in households either consuming the animal-sourced foods (ASFs) they produce or using income from ASF sales in a way that contributes to better nutrition. Livestock programs that address these constraints and opportunities are better suited to achieve better nutrition outcomes. These factors are explored here.

HOUSEHOLD GENDER DYNAMICS

Gender dynamics and issues regarding women's empowerment, ownership of livestock, and labor burden impact the degree to which livestock ownership and the production of ASFs can improve chronic undernutrition. This is particularly relevant considering that two-thirds of poor livestock owners are women from rural areas.¹ Targeting livestock interventions toward women, especially for smaller livestock and dairy, is critical for a positive nutrition outcome.² Broadly speaking, when women control financial and food resources, they are more likely to spend it on their household's nutrition and health than if men control those same resources.³ Women in Kenya use their

1. Jimmy Smith et al., "Beyond Milk, Meat, and Eggs: Role of Livestock in Food and Nutrition Security," *Animal Frontiers* 3, no. 1 (2013): 6–13.

2. Rebecca Huss-Ashmore, "Livestock, Nutrition, and Intrahousehold Resource Control in Uasin Gishu District, Kenya," *Human Ecology* 24, no. 2 (1996): 191–213; Lora Iannotti, Ellen Muehlhoff, and Deirdre McMahon, "Review of Milk and Dairy Programmes Affecting Nutrition," *Journal of Development Effectiveness* 5, no. 1 (2013): 82–115.

3. Duncan Thomas, "Intra-Household Resource Allocation: An Inferential Approach," *Journal of Human Resources* 25, no. 4 (1990): 635–664.

decisionmaking power to ensure that their youngest children receive fresh cow's milk.⁴ When Kenyan women outright own or co-own livestock with male family members, children both consume more ASFs and are less stunted than when only men own a family's livestock.⁵

In many cultures, women and girls bear many of the animal husbandry responsibilities for lactating animals and small livestock, which provide them with greater control of the resources from those animals.⁶ In many places, women may own small animals, although large animals generally belong to men. This is not always the case; in Rwanda, men customarily maintain cow ownership and milking. When women own livestock, they more often control associated food and financial resources and direct those resources to their children's nutrition.⁷ However, as livestock production becomes more profitable and intensified, livestock-related assets, food, and income once controlled by women are often transferred into the hands of men. In one study from Kenya, in small and medium-size dairy farms the majority of decisions about milk sales involved women, and women received the proceeds from the milk in around two-thirds of the cases. For larger farms, the pattern was reversed.⁸

Land O'Lakes worked to elevate the role of women in livestock care and decisions on household expenses through their behavior change communications campaign and gender sensitization training. There is some evidence that these efforts worked. For example, one young woman selected by her community to become a model farmer with RDCP-II learned how to milk cows and participated in gender sensitization training. Her husband of 11 years previously did not allow her to touch their family's cow, affectionately named "Attractive," because it is not customary in Rwanda for women to milk cows. But, after the training, she explained to him that women could both milk and even manage household finances, to which he agreed. Now, she also milks their family's cow and manages the books to record daily milk production and sales.

Greater production of ASFs can adversely impact children's nutrition via increased labor burdens for women. As women's labor increases, the quantity and quality of childcare provisioning may decline.⁹ This may result in women being less engaged in activities that contribute to better nutrition—such as ensuring that children are eating healthy meals or breastfeeding (see Box 5.1). It may also mean that older girls are kept from school to care for their younger siblings while their mothers work.

Livestock interventions that improve nutrition outcomes must find ways to both involve women in a way that maintains their control over animal and financial resources while also increasing

4. Amanda J. Wyatt et al., "Dairy Intensification, Mothers and Children: An Exploration of Infant and Young Child Feeding Practices among Rural Dairy Farmers in Kenya," *Maternal and Child Nutrition* 11, no. 1 (2015): 88–103.

5. Minchao Jin and Lora L. Iannotti, "Livestock Production, Animal Source Food Intake, and Young Child Growth: The Role of Gender for Ensuring Nutrition Impacts," *Social Science and Medicine* 105 (2014): 16–21.

6. Rosemary Rawlins et al., "Got Milk? The Impact of Heifer International's Livestock Donation Programs in Rwanda on Nutritional Outcomes," *Food Policy* 44 (2014): 202–213.

7. Smith et al., "Beyond Milk, Meat, and Eggs."

8. Huss-Ashmore, "Livestock, Nutrition, and Intrahousehold Resource Control."

9. Rawlins et al., "Got Milk?"

BOX 5.1. Dairy Production and Breastfeeding

Greater dairy production could cause women to stop exclusively breastfeeding infants under six months old—a practice recommended by the WHO to reduce the likelihood of childhood malnutrition. Women from households that produce dairy are more likely to introduce cow milk into the diets of infants at less than six months of age than those in nondairy households.¹ Higher levels of dairy production are negatively associated with exclusive breastfeeding—an association that remains significant when controlling for other factors.² The availability and convenience of feeding cow milk is a possible explanation,³ in addition to the fact that women may be engaged in more productive labor.⁴ Efforts to improve nutrition through dairy interventions should be coupled with those that promote exclusive breastfeeding.

1. Wyatt et al., “Dairy Intensification, Mothers and Children.”

2. Ibid.

3. Smith et al., “Beyond Milk, Meat, and Eggs.”

4. Wyatt et al., “Dairy Intensification, Mothers and Children.”

productivity and ensuring that growing labor demands are coupled with quality childcare, including breastfeeding.

CULTURE AND BEHAVIOR

Often overlooked in agricultural development programs that aim to affect nutrition is the cultural context for understanding what people eat and why. Behaviors associated with foods, food preparation, and related household practices are deeply embedded in individual, household, and community sociocultural norms. What foods are eaten is a deeply personal choice and is influenced by how individuals are raised and their community’s culture and traditions. In many sub-Saharan pastoralist cultures, the consumption of poultry and eggs is considered lowly and particularly inappropriate for women, for example. Convincing someone to eat something not considered culturally appropriate is challenging and should be approached with caution.

The promotion of behavior changes regarding food consumption practices, therefore, is a critical component to nutrition programs. This often includes education (or behavior change communication strategies) regarding the benefit of nutritious and complete diets. Nutrition-oriented livestock interventions are less likely to be effective if they do not incorporate some form of nutrition education around the consumption of ASFs.¹⁰ Promoting behavior changes, however, must go beyond education. Other factors in addition to knowledge, such as systems of rewards and threats, social support, peer behavior modeling, believing that change is not only possible but necessary, exemplary leadership from “champions,” empowerment, and an enabling policy environment, are also necessary for behavior change to take place successfully.

10. Wyatt et al., “Dairy Intensification, Mothers and Children”; Iannotti, Muehlhoff, and McMahon, “Review of Milk and Dairy Programmes Affecting Nutrition.”

Cultural contexts also factor into animal production and off-take. Livestock ownership in many parts of Africa reflects a household's social status, where the greater number of cows owned, the higher the social standing of an individual or household. Transferring ownership of livestock can also play an important role in a community—by strengthening social capital through the sharing or loaning of animals or as use for dowry or bride price.¹¹ Because of the prestige that livestock ownership brings, households may avoid selling their animals at the optimal age for commercial slaughter, or they may breed their animals for attributes that do not enhance food production, such as horn size and shape, disposition, or hide color.

ECONOMIES AND INCOMES

A significant constraint on the success of livestock interventions is the depth of poverty of a household or community. Costs of maintaining livestock, costs of consuming ASFs, and access to markets all influence the degree to which livestock can support better nutrition.

The cost of caring for livestock is a noteworthy barrier for households at the bottom of the pyramid to produce ASFs. This is particularly the case for animals that are not pastured and are fed grains or other types of feed brought to animals. Access to feed is important for intensification. Because of the cost of purchasing feed, the marginal economic benefit of intensifying dairy production is often so slim that there is little incentive for poor families to intensify production.¹² As a result, inadequate livestock nutrition is a major constraint for poor smallholder farmers, especially in Africa.¹³ As one extremely poor mother of a malnourished child explained in Rwanda, “Even if the government selected me to receive a cow, I could not accept it because I have no land to feed it. It would be good to get eggs so I can have poultry, or even a goat. Chickens and goats do not need as much land.” Other inputs, such as vaccines and veterinary services, represent a similar barrier for poor livestock producers. Due to the costs of inputs, livestock programs are less effective if poor households are not provided additional resources.¹⁴ Without such transfers, livestock programs aiming to make market-level changes could inadvertently squeeze out smaller producers. There is evidence that wealthier livestock owners in the Horn of Africa have been the primary beneficiaries of a growing export market for cattle in the region, whereas poorer livestock owners have stopped raising livestock altogether.¹⁵

Even when poor households do manage to raise livestock and produce food from their animals, the high value of ASFs motivates households to sell rather than consume the foods themselves. Researchers in Ethiopia found that poor families do not consider the consumption of milk and eggs

11. Thornton, “Livestock Production”; T. F. Randolph et al., “Invited Review: Role of Livestock in Human Nutrition and Health for Poverty Reduction in Developing Countries,” *Journal of Animal Science* 85, no. 11 (2007): 2788–2800.

12. Randolph et al., “Invited Review.”

13. Thornton, “Livestock Production.”

14. Iannotti, Muehlhoff, and McMahon, “Review of Milk and Dairy Programmes Affecting Nutrition.”

15. Yacob Aklilu and Andy Catley, *Livestock Exports from the Horn of Africa: An Analysis of Benefits by Pastoralist Wealth Group and Policy Implications* (Medford, MA: Feinstein International Center/Tufts University, 2009).

from their own livestock affordable.¹⁶ In the case of the Feed the Future dairy program in Rwanda, once beneficiaries were producing greater quantities of milk and had gained better access to markets, a greater portion of their milk production (including both evening and morning milk) was sold rather than kept for home consumption, despite an overall increase in milk consumption.

For households that do not produce ASFs, the relatively high costs of these foods may be prohibitive. In Kenya, researchers surmised that the affordability of milk influenced whether households that did not produce milk considered it to be important to their children's diets.¹⁷ Even when poor households consume ASFs, intra-household food allocation patterns can result in vulnerable women and children getting less than they need.¹⁸

The ability of livestock ownership to improve nutrition or to reduce poverty is influenced by existing poverty levels. Households at the very bottom of the pyramid are less likely to benefit from livestock ownership than those that are a step or two wealthier. One study of 16 countries found that the poorest of the poor are often less dependent on livestock than those that are slightly less poor.¹⁹ However, the relative impact of livestock ownership on both income and nutrition is greater for poor households—regardless of the degree of poverty—than for households that are wealthy. Poor households' income share from livestock is often greater than that of wealthy households.²⁰ While households connected to markets are more likely to sell than to consume ASFs, when market access is limited, livestock ownership increases ASF consumption at home. As a result, livestock interventions are more likely to positively affect chronic undernutrition among poor families in remote, rural locations where markets are weak. Such households are often more vulnerable than households that have access to markets and should thus be a primary focus of development initiatives like Feed the Future.

Livestock interventions are more likely to positively affect chronic undernutrition among poor families in remote, rural locations where markets are weak.

INSTITUTIONS AND POLICIES

Government institutions and the legal, regulatory, and policy framework can affect the ability for livestock systems to grow, prosper, and potentially have a positive impact on poverty and nutrition. However, governments often tend to overlook the needs of livestock-raising communities due to the cultural and physical distance between these two groups. Government administrators are often drawn from crop farming communities and are potentially less attuned to the needs of livestock

16. H. A. Aklilu et al., "How Resource Poor Households Value and Access Poultry: Village Poultry Keeping in Tigray, Ethiopia," *Agricultural Systems* 96, no. 1–3 (2008): 175–183.

17. Wyatt et al., "Dairy Intensification, Mothers and Children."

18. Jef L. Leroy and Edward A. Frongillo, "Can Interventions to Promote Animal Production Ameliorate Undernutrition?," *Journal of Nutrition* 137, no. 10 (2007): 2311–2316.

19. FAO, *World Livestock 2011: Livestock in Food Security*.

20. Ibid.

producers. Also, people engaged in livestock management are often easy to overlook: they often live in remote areas far from capital centers, and some nomadic pastoralist groups do not align with a single nation-state because their herds cross borders.²¹

Favorable regulatory environments, tax and tariff incentive structures, pro-livestock budgeting, and infrastructure investments can make it easier for producers of livestock and ASFs to grow their enterprises. This requires governments to invest in policies that support livestock commercialization and growth. Land use policies are one government mechanism that can influence livestock production. Many livestock-keepers across sub-Saharan Africa are pastoralists and manage livestock extensively. In arid and semiarid parts of sub-Saharan Africa, extensive livestock production is an efficient use of land, since crop production is more vulnerable in drought-prone and highly variable climates.²² Access and rangeland rights for livestock are barriers to sustainable, extensive livestock livelihoods. Settlement policies can erode the viability of extensive livestock systems. In Uganda, former pastoralists now reliant on rain-fed crops are less able to cope with frequent drought periods, weakening food and nutrition security.²³ In Rwanda, land redistribution policies squeezed extensive pastoral livelihoods as well. Land scarcity in the tiny country justified the policy. That the government simultaneously promoted more productive cattle breeds and zero-grazing management practices indicates that Rwandan policy supports livestock livelihoods suited to its environmental constraints.

Policies and institutions can also improve access to inputs and services that livestock require. Favorable incentive structures—such as tax, tariff, and subsidy policies—and infrastructure to develop markets for animal agriculture inputs, such as vaccines and cold chains for those vaccines, could improve herd health and productivity. Developing budgets that include animal extension services is another way that governments can support the production of ASFs. One approach is to facilitate a regulatory environment that promotes quality veterinary practices by training, certifying, and regulating community animal health workers, for example.²⁴ A perennial challenge is that governments of less-developed countries are cash-strapped and rely on international donors to support extension and other livestock services.

ENVIRONMENT

Livestock production comes with an environmental cost, especially when compared with plant-based foods (Box 5.2 discusses implications for human health). While providing only 13 percent of

21. Sara Pavanello, *Pastoralists' Vulnerability in the Horn of Africa Issues: Exploring Political Marginalisation, Donors' Policies, and Cross-Border Issues—Literature Review* (London: Humanitarian Policy Group, Overseas Development Institute, 2009).

22. Nancy McCarthy et al., *Property Rights, Risk, and Livestock Development in Africa* (Washington, DC and Nairobi: International Food Policy Research Institute [IFPRI] and International Livestock Research Institute [ILRI], 1999).

23. Simon Levine, “‘What to Do about Karamoja?’ Why Pastoralism Is Not the Problem but the Solution,” FAO/ECHO, September 2010, <http://www.celep.info/wp-content/uploads/downloads/2011/07/what-to-do-about-Karamoja.pdf>.

24. I. Scoones and W. Wolmer, *Livestock, Disease, Trade, and Markets: Policy Choices for the Livestock Sector in Africa*, IDS Working Paper 269 (Brighton, UK: Institute of Development Studies, 2006).

the calories and 28 percent of the protein consumed globally,²⁵ livestock production currently requires 30 percent of global agricultural water use,²⁶ 30 percent of earth's arable land,²⁷ and half of the world's grain supply.²⁸ One analysis estimates that producing just one kilogram of beef requires up to 400 square meters of land in pastoral systems and 29 square meters in industrial systems; by comparison, producing a kilogram of poultry or pulses require eight square meters of land.²⁹

This land footprint, as well as other elements (such as methane and nitrous oxide emissions), contributes to climate change. The United Nations estimates that 18 percent of anthropogenic greenhouse gas emissions come from the livestock sector.³⁰ New research suggests that emissions from livestock in East Africa may be lower than previously estimated due to differences in diet and breed, however.³¹

The environmental requirements to produce ASFs are also a major constraint on their growth. As climate change continues to alter ecosystems around the world, the natural resources necessary to produce livestock will become limited. One estimate suggests that growing demand for livestock products will require almost double the amount of freshwater that is currently devoted to agriculture,³² even as fresh surface water availability is expected to decline due to climate change.³³

Changes in weather and temperature associated with climate change will also affect the production of crops for animal feed. Farmland availability is expected to decrease by up to 4 percent by 2050.³⁴ Globally, crop yields are projected to decline by 2.4 percent,³⁵ with yields more

Climate change necessitates livestock production systems to become substantially more resource-efficient if animal-sourced foods are to support food and nutrition security goals.

25. FAO, *World Livestock 2011: Livestock in Food Security*.

26. Y. Ran et al., "Assessing Water Resource Use in Livestock Production: A Review of Methods," *Livestock Science* 187 (2016): 68–79.

27. Henning Steinfeld et al., *Livestock's Long Shadow: Environmental Issues and Options* (Rome: FAO, 2006).

28. Smith et al., "Beyond Milk, Meat, and Eggs."

29. Durk Nijdam, Trudy Rood, and Henk Westhoek, "The Price of Protein: Review of Land Use and Carbon Footprints from Life Cycle Assessments of Animal Food Products and Their Substitutes," *Food Policy* 37, no. 6 (December 2012): 760–770.

30. Steinfeld et al., *Livestock's Long Shadow*.

31. D. E. Pelster et al., "Methane and Nitrous Oxide Emissions from Cattle Excreta on an East African Grassland," *Journal of Environmental Quality* 45 (2016): 1531–1539.

32. Mario Herrero et al., "Livestock, Livelihoods, and the Environment: Understanding the Trade-Offs," *Current Opinion in Environmental Sustainability* 1, no. 2 (2009): 111–120.

33. Z. W. Kundzewicz et al., "The Implications of Projected Climate Change for Freshwater Resources and Their Management," *Hydrological Sciences Journal* 53, no. April 2012 (2009): 37–41.

34. Xiao Zhang and Ximing Cai, "Climate Change Impacts on Global Agricultural Land Availability," *Environmental Research Letters* 6, no. 1 (January 2011): 14014.

35. Alvaro Calzadilla et al., "Climate Change Impacts on Global Agriculture," *Climatic Change* 120, no. 1–2 (July 2013): 357–374.

BOX 5.2. Sanitation and Health Constraints

Livestock production comes with potential risks to human health, which can adversely affect nutritional well-being. Households living in proximity to livestock are at higher risk of experiencing fecal contamination in water and food sources. This can contribute to diarrheal illness, which can directly contribute to malnutrition because the body is unable to absorb nutrition from foods. Environments where diarrheal illness is persistent can lead to stunting.¹ Likewise, livestock can increase human exposure to zoonotic diseases, such as brucellosis or tuberculosis.² Thirteen major zoonotic diseases cause 2.2 million deaths a year, mostly among poor and middle-income populations.³

1. Mosites et al., "The Relationship between Livestock Ownership and Child Stunting."

2. Huss-Ashmore, "Livestock, Nutrition, and Intrahousehold Resource Control."

3. Smith et al., "Beyond Milk, Meat, and Eggs."

significantly falling in the Global South.³⁶ Meanwhile, warmer weather and changes in precipitation can reduce the productivity of pasturelands³⁷ and also weaken livestock through an increase in disease prevalence and higher metabolism rates.³⁸

Overall, land and water scarcity associated with global climate change necessitates livestock production systems to become substantially more resource-efficient if ASFs are to support food and nutrition security goals.³⁹ As seen in Rwanda, natural resource constraints helped catalyze a transition in animal husbandry, from a system of extensive grazing on pasture land to growing fodder crops in an efficiency-maximizing "zero-grazing" system.

Many of these constraints and opportunities are reflected in USAID's *Feed the Future Learning Agenda Literature Review*, which states that livestock "interventions associated with marked improvement in dietary intake and nutritional status have several common characteristics: (1) women have a critical role in the intervention, (2) the intervention includes a nutrition education component, (3) the intervention targets the least nourished, and (4) the beneficiaries have some familiarity with the agriculture systems being proposed."⁴⁰ Overall, it is important to recognize and address these context-specific constraints and opportunities to design livestock programs that maximize nutritional impacts.

36. Tim Wheeler and Joachim von Braun, "Climate Change Impacts on Global Food Security," *Science* 341, no. 6145 (August 2013): 508–513.

37. Francesco N. Tubiello, Jean-François Soussana, and S. Mark Howden, "Crop and Pasture Response to Climate Change," *Proceedings of the National Academy of Sciences of the United States of America* 104, no. 50 (December 2007): 19686–19690.

38. A. Nardone et al., "Effects of Climate Changes on Animal Production and Sustainability of Livestock Systems," *Livestock Science* 130 (2010): 57–69.

39. Thornton, "Livestock Production."

40. Douglas Taren and Halima Alaofè, *Feed the Future Learning Agenda Literature Review: Improved Nutrition and Diet Quality* (Rockville, MD: Westat, 2013).

Conclusions and Recommendations

Strengthening livestock value chains will not reduce chronic malnutrition on its own, but if livestock programs are designed and implemented in ways that take advantage of opportunities and mitigate barriers, there is a better chance for livestock programs to reduce chronic malnutrition. Some conclusions and recommendations can be drawn from both the review of the evidence on the relationship between livestock ownership and chronic undernutrition, as well as the case study of USAID's Feed the Future dairy program in Rwanda.

- *Feed the Future programs in the livestock sector should integrate nutrition into their strategies from the beginning to best achieve nutrition-related outcomes.* Nutrition should be incorporated into Feed the Future livestock programs from the start. Feed the Future programs that use livestock value chains to tackle poverty should identify pathways with outcomes for reduced stunting in their strategies. This approach will help ensure that work done within the strategy will contribute to achieving the nutrition-related goals of Feed the Future and that the right types of key staff (e.g., those with nutrition backgrounds) are advising the program from the start. Excluding nutrition at the outset will make it difficult—if not impossible—to reduce stunting. Even if Feed the Future strategies were not originally designed to achieve nutrition outcomes, it is possible to change the direction, but it requires strong leadership, flexibility, and dedication to nutrition over the long haul. Even in these cases, nutrition should be an integral part of the program design, not an add-on.
- *Livestock programs aiming to reduce stunting should target households with children that are chronically undernourished.* To improve nutrition, it is important to target people who are undernourished who may also have poor access to markets. This often means targeting segments of the population that are extremely poor, even though it can be harder to intervene in these households because they lack the resources needed to support livestock. Programs that aim to build sustainable markets are more likely to target households that are a step or two above the poorest of the poor because they are better equipped to engage in business activities, but they are less chronically undernourished. Complementary activities

to compensate for inadequate access to resources may be necessary to support livestock interventions that aim to reduce chronic undernutrition in extremely poor households.

- *Livestock programs should consider who they are targeting to determine the right type of animal and intervention for the target population;* otherwise, livestock production may be more of a burden to poor households than help. The kind of livestock and livestock products promoted will be able to affect nutrition to different degrees. The poorest of households—those that are often the most undernourished—are less capable of managing large animals such as dairy cows and beef livestock because they do not have land or other resources to care for large animals. Smaller livestock, such as poultry, small ruminants, pigs, and rabbits, however, may be better suited for the extreme poor to manage because they require fewer inputs and the eggs from hens or egg layers can be sold every day, generating a daily income. Likewise, cultural barriers to the consumption of different ASFs should be addressed. If Feed the Future strategies aim to help the poorest and most malnourished households, strategies involving livestock must take this into consideration and target these households appropriately.
- *Market-level livestock program activities should be paired with interventions that aim to change household-level behavior.* Feed the Future programs that work to create market-level changes for livestock and ASFs are unlikely to be able to affect household-level behavior changes unless such strategies are an integrated part of the program. Changing markets for ASFs without a corresponding effort to change behaviors in food-producing households could also adversely affect household nutrition for food producers if favorable markets encourage them to sell their products rather than consuming them at home. This includes changes in how families make decisions regarding finances and nutrition to include both husbands and wives. Achieving changes in nutrition-related behaviors requires intervening at the household level, not just the market level.
- *Livestock interventions that hope to reduce chronic malnutrition must consider the relevance of gender roles within target households.* Gender plays a major role in the financial decisions that households make on managing livestock resources and the foods produced from livestock. Women's ability to care for animals and participate in decisions about the sale and consumption of ASFs from a household's livestock will affect the likelihood of livestock interventions leading to better nutrition outcomes. Women generally make decisions about how to manage these resources based on what is best for their children. Sensitization of program staff and participants of the importance of women's contribution to these decisions is recommended, in addition to specifically targeting both women and men for interventions that support women's empowerment in livestock programs.
- *The environmental and political context influences the success of livestock interventions, and these factors should be accounted for in design.* Feed the Future interventions aimed to increase livestock productivity for both poverty alleviation and nutrition goals are more likely to be successful if the contextual environment supports livestock production. Ecological constraints can catalyze positive change in livestock production systems if backed by policies and a culture that enables such transformational change. This requires an enabling

institutional and policy environment. Governments and donors alike must be forward-looking if they are to successfully and sustainably transform livestock production practices within changing environmental parameters.

- *Strong leadership matters and is key to ensuring that Feed the Future programs (including livestock-focused programs) integrate nutrition.* People and personalities matter. A strong commitment to nutrition from the highest level of USAID leadership in the field is crucial to achieving Feed the Future's nutrition goals. Development actors trained to promote economic growth through agriculture (including livestock and small ruminants) may be unaware of nutrition determinants and inadvertently lead their teams away from achieving nutrition outcomes—unless they are committed to tackling nutrition. Having a positive effect on nutrition takes time, and it is important that there is continuity in this commitment to nutrition as individuals move to new assignments. Missions in Feed the Future countries should work to ensure that leaders are committed to tackling nutrition.
- *Monitoring, evaluation, and learning systems for programs associated with Feed the Future, including those that focus on livestock, should include nutrition indicators.* Indicators of nutritional status are necessary to assess whether livestock programs make viable contributions to nutrition goals. Monitoring, evaluation, and learning systems should illuminate best practices and lessons learned while identifying persistent weaknesses to address. In so doing, these systems elevate the importance of reducing chronic undernutrition for livestock program implementers who are then able to make adjustments accordingly. Funding to support robust nutrition impact evaluations and complementary monitoring, evaluation, and learning systems should be a priority for programs reliant on livestock to drive nutrition goals. All Feed the Future interventions—whether or not they involve livestock—should be developed around these systems and contribute to a sound and context-specific evidence base of what works to reduce chronic undernutrition.

Appendix 1. Inventory of Livestock-based Feed the Future Activities

Bangladesh. Livestock Production for Improved Nutrition program is a relatively new addition to Feed the Future's portfolio in Bangladesh. The program specifically envisions improving livestock productivity and hygiene and health practices to enhance nutrition for women and children.

Ethiopia. There are two Feed the Future projects in Ethiopia that focus on livestock. One, the Agricultural Growth–Livestock Market Development program, works to foster growth and job creation by increasing the competitiveness of dairy and meat value chains. Another, the Pastoral Areas Resilience Improvement and Market Expansion program, is designed to increase household income and climate resilience by building market linkages.

Kenya. Kenya boasts two large-scale Feed the Future projects that involve livestock. One is the Kenya Agricultural Value Chain Enterprises program, which aims to increase productivity and incomes of smallholder farmers and other actors along the value chains for dairy as well as maize and horticultural crops. The other is the Resilience and Economic Growth in the Arid Lands program, which supports livestock-related economic opportunities by investing in community-managed infrastructure and eliminating market constraints.

Liberia. The Food and Enterprise Development program is part of Liberia's Feed the Future strategy. The program aims to increase productivity and profitability of agriculture while improving nutrition through private enterprise growth and agriculture investment. Although livestock is not a core element of this program, it does include a project that is intensifying goat production.

Malawi. Malawi's Integrating Nutrition in Value Chains Feed the Future program is working to encourage sector-wide innovations and strengthen local institutions to improve agriculture value chain competitiveness, including dairy value chains.

Mali. In Mali, the Livestock for Growth Feed the Future program provides technical assistance to sustainably develop a competitive and inclusive livestock sector and value chain by increasing productivity, trade, and market linkages.

Rwanda. The Rwanda Dairy Competitiveness Program II is a core program within USAID's Feed the Future portfolio. RDCP-II's original aim was to develop dairy value chains, but it also has a small behavior change component to encourage dairy consumption by Rwandans.

Appendix 2. Inventory of Livestock-based Feed the Future Innovation Labs

Genomics to Improve Poultry, University of California, Davis. The Lab for Genomics to Improve Poultry seeks to improve household and small farm production of chicken and eggs by applying advanced genetics and genomics approaches to enhance innate chicken resistance to New-castle disease and heat stress.

Livestock Systems, University of Florida. The Lab for Livestock Systems aims to increase resilience of vulnerable populations, reduce the environmental impact of livestock systems, and understand how evolving livestock systems effect food safety and security, human nutrition, and human and animal health.

About the Author

Kate McMahon is an expert on food security, resilience, and environmental programs and policy. Over her career, she has embraced a number of roles, from managing a humanitarian food security program in South Sudan, to spearheading advocacy campaigns on environmental and international food security policy in the halls of Congress in Washington, DC, to leading research projects both in the United States and abroad. She has studied, worked, and lived on four continents, including in South and Southeast Asia, Central America, and East Africa. McMahon holds a master of arts in law and diplomacy in humanitarian assistance and conflict resolution from the Fletcher School of Law and Diplomacy at Tufts University; a master of science in agriculture, food, and environment from the Friedman School of Nutrition Science and Policy at Tufts University; and a bachelor of arts in environmental studies and anthropology from Hampshire College.

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