

Feed the Future Innovation Lab

For Collaborative Research on Global Nutrition



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Gerald J. and Dorothy R.
Friedman School of
Nutrition Science and Policy

Feed the Future Innovation Lab
For Collaborative Research on Nutrition - Asia

Annual Report
FY 2014 (Year 4)



Submitted by the Management Entity:
Friedman School of Nutrition Science and Policy
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Boston

**Feed the Future Innovation Lab
For Collaborative Research on Nutrition - Asia**

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Management Entity Information

Tufts University's Friedman School of Nutrition Science and Policy is the Management Entity for the Feed the Future Innovation Lab for Collaborative Research on Nutrition – Asia (hereafter called the Nutrition Innovation Lab – Asia). Its activities are funded under grant contract AID-OAA-L-1-00005 from the United States Agency for International Development (USAID).

Core Management Team	Position	Email Address
Patrick Webb	Program Director	Patrick.Webb@tufts.edu
Eileen Kennedy	Co-PD	Eileen.Kennedy@tufts.edu
Shibani Ghosh	Assoc. Director, Technical	Shibani.Ghosh@tufts.edu
Diplav Sapkota	Local coordinator, Nepal	Diplav.Sapkota@tufts.edu
Liz Marino-Costello	Program Manager	Elizabeth.Marino-Costello @tufts.edu

Global Technical Advisory Committee Information

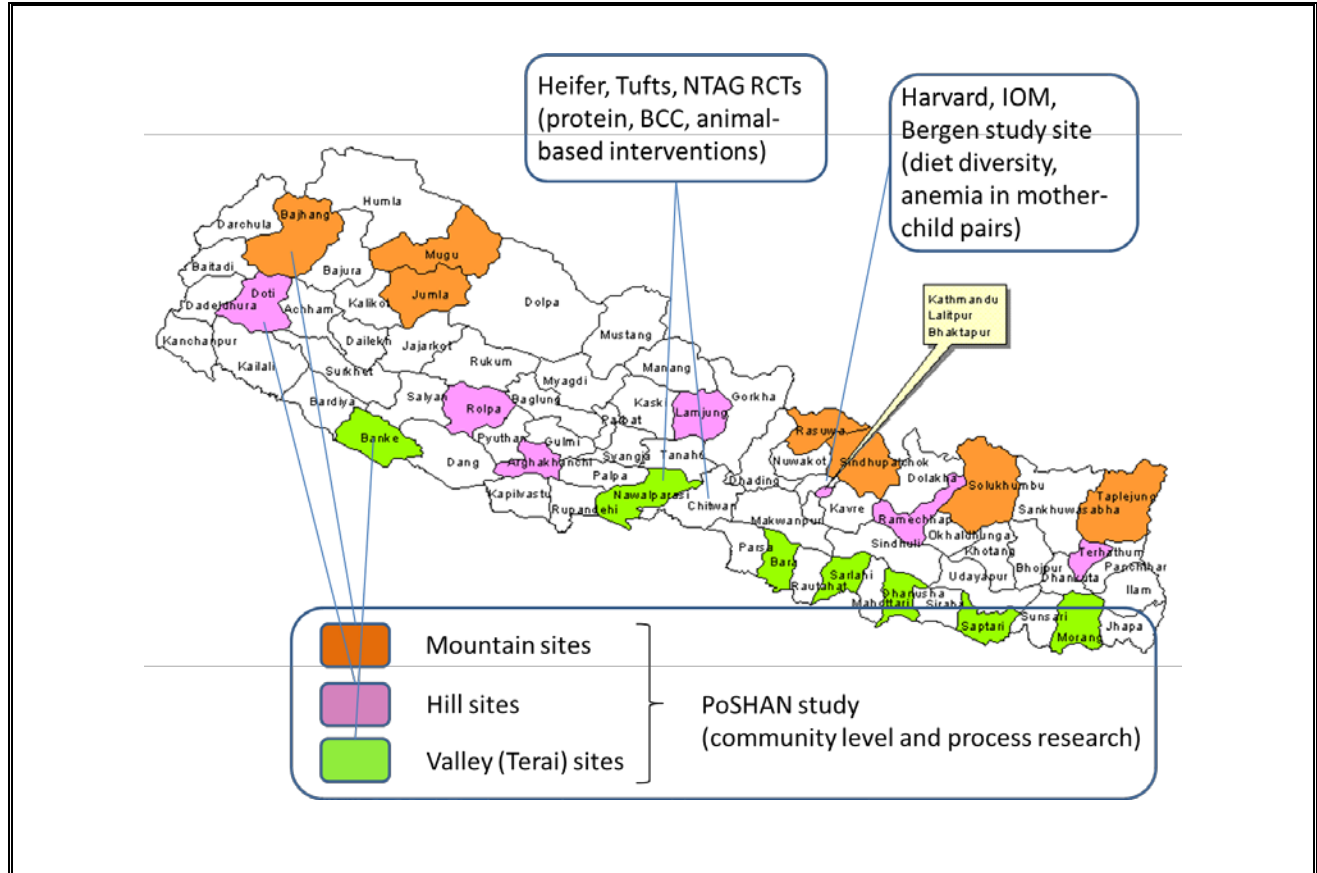
Technical Advisory Committee	Position	Institution	Email Address
Shakuntala Thilsted	External advisor	Senior Nutrition Advisor, WorldFish Center, Bangladesh	sht@life.ku.dk
Richard Deckelbaum	External advisor	Director, Institute for Human Nutrition, Columbia University	rjd20@columbia.edu
Ram Shrestha	External advisor	Founder and Director, Nepalese Technical Advisory Group (NTAG)	ramntag@gmail.com
Shelley Sundberg	External advisor	Senior Program Officer, Bill and Melinda Gates Foundation	Shelley.Sundberg@gatesfoundation.org
Ann Tutwiler	External advisor	Bioversity, Rome	a.tutwiler@cgiar.org
Stephen Vosti	External advisor	Faculty, University of California, Davis	svosti@ucd.edu
Barbara Seligman	Core partner representative	Technical Area Manager, Health, Development Alternatives, Inc.	Barbara_Seligman@dai.com
Maura Mack	Agreement Officer's Representative (AOR)	Nutrition Advisor, USAID BFS	mmack@usaid.gov
Ahmed Kablan	Activity Manager	International Nutrition and Public Health Advisor, USAID BFS	akablan@usaid.gov

Nepal Technical Advisory Committee (Nepal TAC) – established by the Government of Nepal’s National Planning Commission as a local oversight body for the work of the Nutrition Innovation Lab – Asia.*

Name	Title/Function	Institutions
Atmaram Pandey	Secretary (Retd.)	National Planning Commission (Ministry of Defense)
Radha Krishna Pradhan	Program Director	National Planning Commission
Kedar Baral	Vice Chancellor	Patan Academy of Health Sciences
Man Kumaru Rai	Faculty	Institute of Medicine
Indira Sharma	Faculty	Padma Kanya College
Aanya Sharma	Faculty	Nepal Medical College
Uma Koirala	Faculty	Tribhuvan University
Shushila Mala	Member	Nepal Nutrition Alliance
Kanti Lala Bhandari	Retired	N/A
Amit Bhandari	Retired	N/A
Representative	Government official	Ministry of Health and Population
Representative	Government official	Ministry of Local Development
Representative	Government official	Ministry of Education
Representative	Government official	Ministry of Physical Planning
Representative	Government official	Ministry of Agriculture and Cooperatives
Representative	Government official	Nepal Health Research Council

* Not to be confused with the Nepal Technical Advisory Group (NTAG), one of the Nutrition Innovation Lab - Asia’s core collaborating partners in Kathmandu.

Map indicating main Nepal study sites



This map highlights the locations of a variety of interlinked studies that are framed by an overall research protocol. Twenty-one of the sites are the focus of a) community level research undertaken by Johns Hopkins University, with NTAG, the Institute of Medicine, the Nepal Agricultural Research Council, and also b) policy process research led by Tufts University with Patan Academy of Health Sciences, Tribhuvan University and Helen Keller International, with support from the Child Health Division of the Ministry of Health and Population.

Several additional sites are the locus of complementary studies conducted by i) Harvard University (in collaboration with University of Bergen and the Institute of Medicine); ii) Heifer International (in collaboration with NTAG and Tufts), iii) University of Georgia, with Tufts University, iv) Tufts University (in collaboration with Patan Academy of Health Sciences (Nepal), and Helen Keller International), on aflatoxin exposure and nutrition, and v) Save the Children (in collaboration with Tufts and Suaahara), on frontline worker service deliverers' knowledge and practices relating to the Suaahara program's nutrition, health and agriculture interventions.

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List of Program Partners

US Partners

- Johns Hopkins University
- Harvard University
- Purdue University
- Tuskegee University
- University of Georgia
- University of California (Davis)
- Colorado State University
- University of North Carolina
- Development Alternatives, Inc. (DAI)
- International Food Policy Research Institute (IFPRI)
- National Aeronautical and Space Agency (NASA)

Nepal-based Partners

- Tribhuvan University/Institute of Medicine
- Patan Academy of Health Sciences
- Nepali Technical Assistance Group (NTAG)
- Helen Keller International (HKI, Nepal)
- Save the Children/Nepal (USAID Suaahara program)
- Winrock International/Nepal (USAID KISAN program)
- National Agriculture Research Centre
- Heifer Nepal

Other international partners

- University of Bergen (Norway)
- Leverhulme Centre for Integrated Research on Agriculture and Health - University of London
- London School of Hygiene and Tropical Medicine
- UNICEF
- Save the Children
- Heifer International
- Australian Department of Foreign Affairs and Trade (DFAT)
- University of Jakarta
- WorldFish (Bangladesh)
- WorldFish (Malaysia)
- St. Johns Research Institute (India)
- SPRING (USAID program)

Acronyms

AusAID- Australian Agency for International Development
BBNC - Bangalore-Boston Nutrition Collaborative
BIFAD - Bureau for International Food, Agriculture and Development
DAI - Development Alternatives Inc.
GAIN - Global Alliance for Improved Nutrition
HKI - Helen Keller International
IFPRI - International Food Policy Research Institute
IOM - Institute of Medicine (Nepal)
LCIRAH- Leverhulme Centre for Integrated Research on Agriculture and Health (University College London)
NGO - Non-governmental agency (or private voluntary organization)
NASA - National Aeronautical and Space Agency
NTAG - Nepali Technical Assistance Group
PAHS - Patan Academy of Health Sciences (Nepal)
UNICEF -United Nations Organization for Children
UNSCN -United Nations Standing Committee on Nutrition
VaRG - Valley Research Group (Nepal)

I) Executive Summary

The Nutrition Innovation Lab seeks to discover how investments in agriculture can be enhanced to accelerate gains in nutrition, and how policy and program interventions can more effectively be integrated to cost-effectively achieve improvements in maternal and child nutrition at scale. It also pursues innovative research at the frontiers of biology and policy, such as exploring the links between aflatoxins and nutrition outcomes, the role of livestock promotion in enhancing diet quality, and the links between sanitation (open defecation practices) and nutrition outcomes. Combining resources from Nepal, US institutions, and global partners, the research and capacity building activities of the Nutrition Innovation Lab focus on operationally and policy-relevant work that supports both national government and USAID priorities. During 2013/14, the Nutrition Innovation Lab—Asia continued its complex and challenging set of activities in Nepal, and began expanding into other parts of Asia (Bangladesh, Cambodia and Timor-Leste). This has involved strengthening relationships with more institutional partners (including other Innovation Labs) in the US and globally (including Save the Children, Patan Academy of Health Sciences, UNICEF, SPRING, and NASA).

Regarding the research agenda, a second round of empirical data collection was completed in 21 field sites, involving surveys of around 5,000 households and almost 800 policymakers and program implementers (the latter using electronic tablet-based survey instruments). Preliminary results from the first round surveys were presented at several policy dissemination meetings in Kathmandu. Dissemination documents were prepared for distribution in-country, including policy briefs shared with government partners and the mission, as well as 21 district-specific 'feedback' briefs shared with district-level interlocutors, and a summary document on the household level data. Additional studies were completed by core partners (on changes in peri-urban diets and micronutrient status, inclusion of livestock products in diets and growth outcomes, and seasonality effects on birth outcomes and nutrition). New studies at the frontiers of agriculture and nutrition were also initiated, including the assessment of links between aflatoxin exposure (measured in the blood of women and children) and nutrition outcomes in Timor Leste, and preparation for an Associate Award-funded birth cohort study in Nepal on the same topic. A frontline workers survey was also in the planning stage, in collaboration with in-country partners, aimed at documenting knowledge and practices linked to health and agriculture programming. New research in other countries will be pursued in FY15 as an Associate Award was secured for research on aquaculture and horticulture links to nutrition in Bangladesh.

Human and institutional capacity building activities were an equally important part of the Nutrition Innovation Lab-Asia agenda. A total of 6 Nepali students were supported in their graduate studies, 103 individuals received various forms of shorter-term skills training, while 250 individuals participated in discussion of, cutting edge research methods and policy-relevant findings at the second annual Innovation Lab-supported Scientific Symposium. Assistance continues to be given to local partners on curriculum development for graduate degree programs in nutrition, and funding support was secured from the USAID/Nepal mission for the third Scientific Symposium to be held in Nepal, in which interest continues to grow.

II) Program Activities and Highlights

The Nutrition Innovation Lab's research in Nepal went to scale during 2013/2014. A second full round of data collection was completed, with analysis underway:

PoSHAN community-level research

A total of 4,287 households (including 5,400 children under 5 years of age and 4,500 mothers) were surveyed in 21 research sites by Johns Hopkins University (in collaboration with Tribhuvan University and the National Agriculture Research Council of Nepal). This major component of the PoSHAN research focuses on understanding the paths by which agriculture impacts on nutrition and health over time and seeking to understand programming and policy fidelity where cross-sector interventions are implemented to achieve enhanced nutrition; preliminary data have been compiled and presented at a dissemination meeting in Kathmandu in February 2014. Roughly 12 papers based on these data are currently in various stages of preparation.

PoSHAN policy process research

A matched research component has focused on understanding the process of program and policy implementation. Tufts University (collaborating with Patan Academy of Health Sciences, Helen Keller International and the Institute of Medicine at Tribhuvan University) leads novel delivery science research that involves annual interviews with more than 780 civil servants, policymakers and program implementers involved in putting nutrition policies and interventions into practice in the same 21 districts sites as the Johns Hopkins PoSHAN study (reported above). This will permit an empirical assessment of the extent to which knowledge, attitudes and practices of individuals charged with cross-sectoral collaboration for nutrition actually influence program and policy fidelity, as well as household-level outcomes observed on the ground. Preliminary data were presented both in Kathmandu (at a policymaker dissemination meeting) and at a conference in London in 2014. Three Innovation Lab policy briefs have been finalized and shared with partners in-country (including the mission). A second stream of analysis has been exploring the creation and validation of new metrics of the 'quality' of nutrition governance, seeking to measure commitment and capacity stakeholders in different ways. Several papers are being prepared on this work for journal publication.

PoSHAN diet diversity, protein intake, and micronutrients research

During Y4, the Nutrition Innovation Lab-Asia continued to support studies led by Heifer International in partnership with NTAG and Tufts University's School of Medicine, as well as by Harvard University with the Institute of Medicine of Nepal and Norway's University of Bergen. There are two Heifer components:

- a. One is a randomized control trial of a livestock-based community intervention linked to enhanced nutrition knowledge. Seeking to understand impacts on child nutrition, communities were randomized to receive one of 3 interventions: 1) a range of community development activities, livestock training, and training in child nutrition (behavior change communication or BCC), 2) livestock training and nutrition training (BCC) alone, or (3) no intervention as a control group. A total of almost 1,000 households (containing more than 1,300 children under 5) make up the total sample, split roughly equally across the study arms. One paper is under review for publication.

- b. The other is a follow-up survey of a cohort of 389 (out of 415 originally surveyed) households in 3 districts (Nawalparasi, Chitwan, and Nuwakot) previously studied by Heifer from 2009 to 2011. The 4th year follow up allows for a longer period of assessment of rural development activities on health and nutrition (including dietary diversity and child growth). Two papers are being prepared based on these data.
- c. The Harvard-led study is focused on a separate peri-urban site, based on a follow-up of mother and infant pairs originally surveyed in 2008 to assess how diets and health have subsequently impacted various manifestations of nutritional wellbeing. Around 350 of the original 500 pairs were included in the follow-up. One paper has already been published on this work (see Appendix 3), and two more are under review for publication.

Secondary data analyses on links among agriculture, agro-ecology, food systems and nutrition

- d. Under the auspices of the Nutrition Innovation Lab-Asia, a major effort has been underway at Purdue University to link multiple large secondary data sets to measure connections between child growth and a wide range of determinants believed to influence health and nutrition. The Purdue team includes partners in Nepal, and collaborators at IFPRI, the University of North Carolina, Tufts University and NASA (see Success Story No. 2 below). A set of monthly data on agricultural prices covering more than 45 districts and 20 commodities (approximately 40,000 data points over the period 1998-2011) has been linked to multiple rounds of the Nepal Living Standards Survey (NLSS) and are also using several rounds of the Nepal Demographic and Health Survey (DHS) data, as well as remotely sensed satellite data recorded over the past decade by the Global Inventory Monitoring and Modeling Systems (GIMMS) group at NASA's Biospheric Sciences Branch. Two papers have been published on this work during 2014 (see Appendix 3).
- e. Using global secondary data, the London School of Hygiene and Tropical Medicine has worked with Tufts University on an analysis of trends and associations among dietary patterns (using FAOSTAT data) and nutrition outcomes (stunting as well as obesity) and non-communicable diseases. The data proved harder to collect and combine than anticipated, so the analysis is still ongoing, with a paper anticipated by early in 2015.

Capacity building

A third Scientific Symposium was planned and organized to be held in Kathmandu in November 2014, fully funded by the USAID mission in Nepal. The aim is to attract more than 300 applications for participation (compared with 150 in the first Symposium). The standard of presentations is expected to rise since interest among government representatives remains very high. Additionally, as part of the institutional capacity building agenda, the Nutrition Innovation Lab-Asia will host a special event at which packets of Social Science Library materials will be formally handed over to 14 local academic and research institutions. These packets, including CDs containing thousands of peer-reviewed articles relating to several social science disciplines of relevant to agriculture, environment, economics and public health, will be made available to the institutions for free by Tufts University. Invitations to those institutions were sent out with a 100% positive response rate.

Individual capability building involved 14 people receiving short-term trainings and 6 engaged in graduate degrees. In addition, as part of the Scientific Symposium the Nutrition Lab organized an additional special technical workshop aimed at researchers and students on the theme of 'what constitutes rigorous evidence to support policymaking and program design?' This was attended by roughly 40 Nepal-based faculty, researchers, agency and government analysts and students (all by invitation). Presentations are being planned by Drs. West, Klemm, Dangour and Webb. A student poster session will also be organized, involving formal feedback from pairs of Nepali and international faculty -- prizes to be awarded for the top three posters. These additional activities are being planned based on experiences and feedback from participants in the first two Scientific Symposia, meaning that the Nutrition Innovation Lab-Asia is responding directly to expressed demand for even more capacity building events.

Forty-two formal presentations were made by the many researchers involved in the innovation lab's activities, reaching an aggregate audience in FY2014 of almost 2,400 people. All of these activities highlight the important catalyzing role played by the Nutrition Innovation Lab-Asia in promoting science and policy dialogue in Nepal.

Table 1: Summary of Key Goals and Achievements for FY 2014

Research Plans	
Theme A: Understanding agriculture-nutrition linkages (Target - 10 papers prepared)	- ACHIEVED
A.1 Empirically populating conceptual pathways from agriculture to nutrition outcomes	
➤ Second full round of household data collected at 21 principal research sites in Nepal	- ACHIEVED
➤ First <i>inter-seasonal</i> round of household and community data collected at 3 Sentinel Sites	- ACHIEVED
A.2 Exploring neglected biological mechanisms linking food systems and nutrition	
➤ Initiate new research on water quality and nutrition outcomes in 3 sentinel sites	- NOT ACHIEVED
➤ Analysis of aflatoxin links to nutrition from blood samples from Timor Leste; pursue opportunity to conduct aflatoxin assessments relating to nutrition in Nepal	- ACHIEVED
➤ Initiate collaborative research on microbiome pathogens at rural sites in the Terai, with Heifer and Virginia Tech (funded through Livestock/Climate Change Lab)	- CANCELLED
A.3 Explore links among diet quality and nutrition	
➤ Analyze dietary pattern data to assess validity of food diversity scores and other metrics of diet quality in relation to animal source protein, fruit/veg consumption and nutrition	- ACHIEVED
➤ Analyze panel data from Bhaktapur on diet quality and anemia in mother-infant pairs	- ACHIEVED
➤ Exploring potential opportunities for collaboration on linking diet quality, the role of fish and aquaculture in nutrition (Cambodia, Bangladesh and Nepal)	- ACHIEVED
A.4 Econometric analyses of secondary data	
➤ Analysis of secondary Nepal datasets (nutrition linked to productivity, climate change)	- ACHIEVED
➤ Analysis of global datasets on diet trends, nutrition outcomes and health	- ONGOING
Theme B: Understanding multisector programming for nutrition (Target - 2 papers)	- ACHIEVED
B1. Understanding multisector interventions	
➤ Second round of program exposure and service delivery surveys at 21 field sites	- ACHIEVED
➤ Collaboration with Suaahara and KISAN program implementers on program research	- ACHIEVED
➤ Pursue options for research on complex programming in Bangladesh, Cambodia	- ACHIEVED
B2. Assessing impact of nutrition-specific components of nutrition-sensitive programs	
➤ Deepen data collection on service delivery and program exposure at 21 field sites	- ONGOING
➤ Analysis of behavior change communication impacts on nutrition	- ONGOING
Theme C: Understanding policy and programming processes (Target - 2 papers)	- ONGOING
C1. Process Research. Conduct 2nd round of policy/process interviews at 21 field sites;	- ACHIEVED
C2. Program Fidelity Research. Initiate data collection on fidelity of Training of Trainers under USAID Suaahara, and develop new Suaahara-specific programming study components.	- ACHIEVED

Human and Institutional Capacity Development Plans	
Short-term training	
➤ Support 4 Nepalis to receive short-term (BBNC and summer class) training	- ACHIEVED
➤ Support 30 Nepalis for training in research methods, analysis and presentation skills	- ACHIEVED
Long-term training	
➤ Continued support for 4 Nepalis to receive graduate degree students at US universities	- ACHIEVED
Institutional Development	
➤ Organize a mission-funded 3 rd Scientific Symposium in Nepal (for Nov 2014)	- ACHIEVED
➤ Provide continued institutional development of partners in Nepal	- ACHIEVED

Governance Plans	
➤ Management of planned External Review of the Nutrition Innovation Lab – Asia	- ACHIEVED
➤ Continued effective management of Nutrition Innovation Lab-Asia resources	-
ACHIEVED	
➤ Dissemination of impactful research outputs via website, presentations, and publications	- ACHIEVED
➤ Presentation of key and relevant issues around agriculture and nutrition to USAID BFS and other USAID units, as requested	- ACHIEVED
➤ Support to other Innovation Labs on incorporation of nutrition objectives into their research portfolios	- ACHIEVED
➤ Exploring opportunities for collaboration with the Aquafish Innovation Lab in Bangladesh and Cambodia	- ACHIEVED
➤ Exploring opportunities for collaboration with other USAID-funded entities (e.g. WorldFish)	- ACHIEVED

III) Key Accomplishments (2013/14)

Theme A (Scientific Research)

The first two targets identified under this theme were reached (see Table 1).

- The target number of **ten** Nepal-based institutions gaining enhanced capacity in nutrition research, monitoring and surveillance methodologies, nutrition information systems, and/or nutrition interventions with USG assistance was met. The institutions comprised: i) the Ministry of Health’s Child Health Division (with which the Nutrition Innovation Lab-Asia has a collaborative MOU and continues to partner with in terms of selection of trainees for the Bangalore training and engagement with multiple ministry stakeholders on the design of a national nutrition surveillance system), ii/iii) two local survey organizations, Valley Research Group and New Era, both received rigorous training and re-training in nutrition survey design, instrument preparation, study implementation and data entry/cleaning and analysis), iv) the Nepal Agriculture Research Council, v/vi/vii) Helen Keller International/Nepal, Heifer International/Nepal, and Save the Children/Nepal whose staff have been fully involved in Innovation Lab-supported nutrition survey design and analysis, viii) the Nepali Technical Assistance Group (NTAG) benefitted from further cutting edge training in nutrition survey methods from Johns Hopkins University, ix) the Patan Academy of Health Sciences was directly involved in nutrition research (through partnership in the PoSHAN research) for the first time, while x) the researchers at Tribhuvan University have worked closely with Harvard (and Bergen University) on data collection and analysis, as well as publications.
- The number of food consumption and/or nutrition surveys undertaken or reported on during FY14 totaled **twenty-six**, exceeding the number planned by 2. This number reflects the huge amount of work undertaken by Johns Hopkins University for the PoSHAN community level research since they organized data collection in 21 separate field sites spread out across the country. In addition, further training and data collection was initiated at the 3 PoSHAN sentinel sites. Thus, the PoSHAN activity alone has completed 24 individual surveys. Separately, there were two additional rounds of diet and nutrition surveys implemented by Heifer with NTAG (and the Tufts School of Medicine) as part of the diet, protein, nutrition studies that involve longitudinal panels and an RCT.

Table 1: Nutrition Innovation Lab Asia Targets and Achievements (FY2014)

Theme (a): Scientific Research				
Outcomes	Indicator Number	Output Indicators	FY 2014 Targets	FY 2014 Actuals
Outcome 1: Improved host country nutrition and food security monitoring, analytics and surveillance capacities	Nutr. Lab 1	Number of U.S. and host country institutions that have gained enhanced capacity in nutrition research, monitoring and surveillance methodologies, nutrition information systems, and/or nutrition interventions with USG assistance	10	10
	Nutr. Lab 2	Number of food consumption and/or nutrition surveys undertaken, or reported on and disseminated	24	26
	Nutr. Lab 3	Number of U.S. or host country institutions or individuals having completed a nutrition assessment, survey or gap analysis.	30	115 ¹
Theme (b): Human and Institutional Capacity Development				
Outcomes	Indicator Number	Output Indicators	FY 2014 Targets	FY 2014 Actuals
Outcome 2: Improved host country academic, technical and research capacity in nutrition, health and agriculture	Nutr. Lab 4	Number of people trained in child health and nutrition (nutrition science, dietetics, public health nutrition) through USG supported programs (longer term – graduate school)	3	6
	Nutr. Lab 5	Number of people trained in child health and nutrition (nutrition science, dietetics, public health nutrition) through USG supported programs (short term – trainings, workshops)	69	103
	N/CRSP 6	Number of US and host country institutions with enhanced capacity to assess, plan, design, implement, monitor and/or evaluate nutrition programs, policies and practices	3	8
	N/CRSP 7	Number of U.S. and host country <i>institutions and individuals</i> who have gained enhanced capacity in clinical, operational, agricultural, translational and/or public health nutrition research aimed at the reduction of malnutrition with USG assistance	50	111
	Nutr. Lab 8	Number of peer-reviewed journal articles co-authored with host country institutions and others in country with USG assistance (submitted or published)	10	14
	Nutr. Lab 9	Number of brief articles and presentations co-authored with host country institutions and others in country with USG assistance	15	28

¹ A much larger number of supervisors and enumerators were trained in the implementation of high-end research instruments in order to have more teams, thereby accelerating the data collection and entry timeframe.

- Third, the number of U.S. or host country institutions or individuals having completed a nutrition assessment, survey or gap analysis exceeded the target set (115 versus 30). Those 115 individuals included: The 3 Nepali co-principal investigators collaborating directly with the Nutrition Innovation Lab-Asia agenda, 3 principal collaborators at Valley Research Group and the 18 enumerators and supervisors who participated in data collection management and data entry for the PoSHAN process research, 2 study leads of the Heifer Nepal research, 3 Institute of Medicine/Harvard principal investigators, the 1 Johns Hopkins local staff and 82 enumerators and supervisors trained to conduct the PoSHAN community surveys, sentinel site surveys and data entry/analysis, and Tufts' 3 Nepali local staff (of Tufts) who helped implement the PoSHAN process data collection, conducting instrument testing and field monitoring trips.

While data collection from those activities has been undertaken, and analyses are underway, a number of research papers and presentations were completed as planned during FY14.

- *Research papers – thirteen papers*, some in Research Brief format posted on the Nutrition Innovation Lab website, and some already formally submitted for publication, for example, to the Food and Nutrition Bulletin, the Annals of the New York Academy of Sciences, and the British Journal of Nutrition (see Appendix 3).
- *Dissemination of research findings*. During FY14, Nutrition Innovation Lab-Asia collaborators (including local partners) made **28 presentations** in a range of impactful venues. These are summarized in Appendix 2. Many were presentations co-authored with Nepali colleagues, others were individual efforts by the ME, US partners as well as Nepali partners. The total (aggregate) audience participating in these presentations came to about 2,400 people—representing individuals directly exposed to new thinking and findings generated by Nutrition Innovation Lab-Asia activities.

Theme B (Human and Institutional capacity-building) The Nutrition Innovation Lab-Asia commitment to capacity building (improving host country academic, technical and research capacity in nutrition health and agriculture) was further strengthened through formal Board adoption of selection criteria for candidates seeking training support. All FY13 targets were met (Table 1 above).

- While the target for longer-term (graduate degree) training was 5, we started support for an additional Nepali MS student in September 2014.
- A Memorandum of Understanding was formalized with Nepal's Patan Academy of Health Sciences (PAHS) to deepen local research partnerships as well as capacity-building activities. Dr. Baral, one of the Nutrition Innovation Lab-Asia's local Principal Investigators, is fully involved in new research on aflatoxins, and in the ongoing process research.
- In terms of the capacity building of individuals (through formal education and training programs), the Nutrition Innovation Lab-Asia supported 6 people with short-term trainings (at the Bangalore-Boston Nutrition Collaborative activity in India) as well as 97 people in other forms of trainings, posters and workshop settings.

IV) Research Program Overview and Structure

The Nutrition Innovation Lab-Asia offers a model for focusing research on food and nutrition in developing countries in line with recommendations from the recent BIFAD external review of funding modalities for US university research.¹ That report notes that the exceptional capacity of the US research community is best leveraged to achieve international development goals when working in a “collaborative, interdisciplinary and development-focused” manner with national institutions on research questions that resonate both at global and local levels (BIFAD 2012, p.9). That perfectly describes the modus operandi of the Nutrition Innovation Labs for Asia and Africa, including:

- A ‘deep-dive’ focus of research in *Feed the Future* priority countries,
- An applied focus (operations or ‘delivery science’ research rather than bench science),
- A focus on country-ownership (supporting research that includes national stakeholders and informs locally-defined priorities in food and nutrition),
- Resources are allocated to few grants at larger scale, rather than many small grants supporting studies of experimental or pilot activities,
- Institutional and human capacities for analysis and policy formulation developed through a mix of formal education (degree programs), short-term training activities, workshops and engagement of local partners in national scientific symposia.

Following these principles, the Nutrition Innovation Labs focus on over-arching research questions: namely, 1) How can investments in agriculture achieve significant measurable impacts in nutrition (can pathways to impact be empirically demonstrated)? 2) How can large-scale programs best incorporate such knowledge into cost-effective multi-sectoral interventions aimed at improving nutrition? and 3) How can policy and program implementation processes be enhanced to support both nutrition-specific and nutrition-sensitive actions?

These overarching questions frame a series of nested studies that seek to generate empirical evidence responding to developing country policymaker concerns, while supporting the goals of the Feed the Future initiative. There is still very limited empirical evidence to support the assumption that higher productivity and diversity of agricultural outputs supports enhanced maternal and child nutrition outcomes. Therefore, the Nutrition Innovation Labs undertake applied research to determine the effectiveness of various approaches to linking agriculture and nutrition in diverse agro-ecological contexts. The research is pursued in ways that seek to enhance policymaker understanding of how to overcome constraints in policy and program design and implementation, while also producing global public goods in the form of new scientific knowledge of relevant and diverse settings.

Tufts University’s Friedman School of Nutrition Science and Policy serves as the Management Entity for the Nutrition Innovation Lab for Asia (as well as that for Africa, which allows for intellectual synergies and cost-savings to both programs). The Friedman School implements the program of work in partnership with several US university partners – Tuskegee, Purdue, Johns

¹ BIFAD (2012). *BIFAD Review of the Collaborative Research Support Program (CRSP) Model*. A Report Commissioned By BIFAD at the Request of USAID. August 2012. Washington, D.C., Mimeo.

Hopkins, and Harvard – as well as Development Alternatives, Inc. The core team manages resources in a manner that allows for the generation of i) empirical evidence of what works in leveraging agriculture for improved nutrition through multi-sector programming, and ii) enhanced institutional and human capacity in Asia to conduct research and implement integrated nutrition activities in future years. Additional US universities (University of Georgia, UC-Davis, and Oregon State University), and European universities (Bergen in Norway and University College London), have also become partners during 2012/2013 as new initiatives have emerged. In all cases, close collaboration is ensured with host country partners, including Tribhuvan University, Nepal’s Institute of Medicine, Patan Academy of Health Sciences, the Nepal Agriculture Research Council, the Child Health Division of the Ministry of Health and Population and the National Planning Commission.

V) Research Project Reports

V.1.1 PoSHAN Community Nutrition Research. The goal is to empirically understand pathways by which interventions in agriculture impact on nutrition, and how such pathways can be enhanced through appropriately designed multisector interventions.

The household-level data collection started with a first round in 2013 (at 21 district sites randomly selected across Nepal), with a second round completed in the summer of 2014. By the end of 2013, preliminary data had been cleaned and reviewed, and frequency distributions produced. A dissemination workshop was conducted in February 2014 to present the preliminary findings from the first round which have subsequently been collated in a report for wide distribution in-country. Data from the second round (from the same households as before) are in the process of being cleaned. Results from both rounds will be presented at the 3rd Scientific Symposium in November 2014 (in Kathmandu).

V.1.2 PoSHAN Policy Process Research. The goal is to empirically determine how approaches to collaboration and the ‘quality’ of policy implementation (determined through the knowledge, attitudes and practices of stakeholders involved in implementing multisector policies and actions), may impact agriculture, health and nutrition outcomes on the ground.

During Y4, a second round of surveys was conducted (using electronic data capture – see Success Story No. 1 below) with more than 780 officials in government and non-governmental stakeholders were interviewed across Nepal. This arm of the PoSHAN research was implemented by Valley Research Group, in collaboration with Tufts University, Helen Keller International and Patan Academy of Health Sciences researchers. The second round of the PoSHAN process research used structured (pre-programmed) instruments to interview policymakers and other stakeholders across 8 sectors of activity relevant to the implementation of a national multi-sector nutrition plan: namely, agriculture (cropping and livestock separately), health, nutrition, water supply, sanitation, local development, other social welfare. Government and other officials in each of these line ministerial functions were identified at each of 5 defined ‘layers’ of sub-national governance (regional, district, ilaka, VDC [village development committee] and ward), and interviewed in relation to their responsibility for the flow of decisions and resources relevant to actions on the ground in the same 21 field sites in which community-level data are being collected under V.1.1 above.

Additional non-governmental stakeholders working on agriculture and nutrition programming were also interviewed at each layer and location. The goal, during FY 2014, was to combine these datasets to permit analysis of potential correlations between the 'quality' of governance relating to policy implementation, its relationship to programming fidelity on the ground, and ultimately to nutrition and health outcomes among households where policies and programs have been targeted. Multilevel modeling has been explored, as well as the creation of indices of commitment and capacity for policy implementation. Preliminary results were presented at the LCIRAH meeting in London in June 2014, and more will be presented at the 3rd Scientific Symposium in Nepal in November 2014.

V.1.3 Randomized control trial of impact on nutrition of specific behavior change communication (BCC) layered over a livestock training intervention. The goal of this study is to determine the value-added of specific nutrition knowledge over and above enhanced knowledge in agriculture (livestock management).

Initiated in early 2013 in one district of Nepal's central hills, this study investigates child nutrition in communities randomized to receive one of three interventions: (1) Heifer community development activities and livestock training, supplemented by specific training in child nutrition, (2) livestock training and nutrition training alone, or (3) no activities. During FY2013, the precise nutrition 'curriculum' for BCC was devised and tested, survey instruments were developed, interviewers were trained, and ethics review board approval was secured. Data collection took place during the early summer without any problems. A total of 960 households were enrolled in the study - 289 assigned to livestock training plus nutrition training; 360 assigned to livestock training only; and 304 assigned to the control group. All households have one or more children under 5, resulting in a total sample of approximately 1,300 children enrolled across the 3 study arms. Preliminary data were analyzed during 2014, leading to several presentations in Boston and in Nepal. A second round of data collection is planned for the same individuals during 2015.

V.1.4 Randomized control trial of multisector interventions framed by livestock development interventions on child nutrition outcomes. The goal is to understand how interventions framed around animal use and women's empowerment a) enhance child dietary quality overall (through direct consumption and/or increased income) and b) animal source food consumption specifically.

Led by Heifer International Nepal and the Nepali Technical Assistance Group, this study examines how measures of dietary diversity correlate with child nutrition outcomes. Designed as a randomized control trial, the study explores associations in the context of an intervention trial in three sets of paired communities in Nepal. Communities were randomly assigned to "control" or "intervention" status. Surveys were completed in 415 randomly selected households at baseline and every 6 months for 2 years (total 5 surveys). The Nutrition Innovation Lab-Asia facilitated additional rounds of data collection during FY13 and FY14, which allows for an extension of the longitudinal panel relating to nutrition outcomes. The data collection took place in the second quarter of 2013 without any hitches, leading to analysis that has continued during FY14. A draft paper has been prepared, with early results looking promising for more than one published article.

V.1.5 *Peri-urban diet and nutrition outcomes (panel survey)* The goal is to assess measures of diet quality in relation to anemia outcomes, child growth and household food security in a panel of mother-infant pairs.

The research focuses on improving measures of diet quality, and to link such measures to other indicators of malnutrition among children and women. By validating tools such as dietary diversity indicators against measures of actual nutrient intake and biochemical status the goal is to enhance the ability of agriculture and nutrition interventions to assess effects they are having on dietary quality. Undertaken by Harvard School of Public Health with Nepal's Institute of Medicine and Bergen University in Norway, this work in Bhaktapur district specifically explores: 1) How indicators based on food group classifications compare in explaining nutrient adequacy controlling for socioeconomic factors; 2) How one-time measures of dietary diversity predict adequacy of nutrients (particularly iron status) compared with multiple measures; 3) The benefits of correcting for intra-person variation in dietary diversity measures; 4) The extent to which maternal diet diversity explains child growth; and 5) The relationship between consumption of animal source foods and subsequent child growth. Roughly 320 mother-infant pairs first surveyed in 2008 were retraced in 2013 and most of 2014 was spent conducting analyses and writing papers. By the end of FY14, 6 paper drafts were under preparation based on these analyses– 5 of those having been submitted for publication.

V.1.6 *Econometric analyses of secondary data linking ecology, food systems, and nutrition* The initial goal is to measure the connections between agricultural capacity, technology adoption, nutrition outcomes, and conditioning factors at levels of aggregation ranging from household to district levels.

This activity moved forward during Y4. Several large datasets were merged by Purdue University, including monthly data on agricultural prices covering more than 45 districts and 20 agricultural commodities. This dataset consists of approximately 40,000 data points representing monthly observations of agricultural prices over the period 1998-2011. We also worked directly with Nepal's Central Bureau of Statistics to assemble multiple rounds of the Nepal Living Standards survey (NLSS) and are also using multiple rounds of the Nepal Demographic and Health Survey (DHS) data, as well as remotely sensed satellite data recorded over the past decade by the Global Inventory Monitoring and Modeling Systems (GIMMS) group at NASA's Biospheric Sciences Branch. Analysis during Y4 has focused on the links between climate anomalies, output of major staple crops by location, timing of birth and subsequent child undernutrition. Several papers have already been published, and more are in the pipeline (see Appendix 3).

VI) Associate Award Research Project Reports

Two Associate Awards were made to the Nutrition Innovation Lab – Asia in Y4. These include one from USAID BFS (Bureau for Food Security) to conduct aflatoxin research and one from USAID BFS coupled with USAID Bangladesh to conduct research on the effectiveness of aquaculture-horticulture interventions.

V1.1 Relationship between Maternal Exposure to Mycotoxins, Birth Outcomes and Stunting in Infants: A birth cohort study in Nepal

According to Khlangwiset et al. (2011), “aflatoxin exposure and its association with growth impairment in children could contribute a significant public health burden in less developed countries.” Similarly, Leroy (2013) argues that “while only a small number of observational studies have been carried out, the majority has found strong associations between aflatoxin exposure and stunted fetal, infant, and child growth, thus providing evidence for the first criterion for causality.” Most observational studies have been conducted in Africa and have yet to be replicated in Asia. Aflatoxin contamination of the food supply in many Asian countries is known to be very high. A recent study in Nepal found 18% of food samples to be heavily contaminated with aflatoxins (Rai et al. 2013), particularly in the Far West region of the country, which has some of the highest rates of stunting in the country (MoHP 2012). Thus, a better understanding of the association between maternal and/or early life aflatoxin exposure (rates in the blood and breast milk) and infant and young child growth is essential if we are to more fully understand and effectively address the high rates of stunting in Asia. Yet, as Wu (2012) points out, the association between aflatoxin exposure and childhood stunting has yet to be well defined. While a number of cross-sectional and a few longitudinal studies have confirmed that higher levels of aflatoxins in foods, cord blood and breast milk are statistically correlated with higher levels of underweight and wasting (Njumbe et al. 2013; Wu 2012; Keskin 2009; Turner et al. 2004), there is an urgent need for prospective studies that appropriately link exposure levels in different diets, household conditions, health parameters to pregnancy outcomes and child linear growth trajectories after birth. As Leroy (2013) puts it, research is critically needed “to unambiguously establish the causal relationship, and to quantify to what extent the current level of aflatoxin exposure contributes to the global burden of stunting.” Given the significant associative relationship of aflatoxin exposure to stunting and height gain in infants and young children, the Nutrition Innovation Lab-Asia will undertake an aflatoxin birth cohort study that aims to further the understanding of the causal relationship between past and current aflatoxin exposure (maternal and infant) and height-for-age in Nepali infants and young children. The study will also aim to validate the use of low cost data collection methods (e.g. dried blood spots versus venous blood samples) for aflatoxin analysis.

The approach taken is to recruit a sample of roughly 1,500 pregnant women in a Terai district in Nepal. Using ethically reviewed gold standards to approach and recruit women, venous blood samples will be requested once during the pregnancy. After birth, there will be two interactions with the mother-infant dyad. A blood sample will be requested from the infant within six months of birth, along with a sample of breast milk used to feed the baby. Another blood sample will be elicited when the child is roughly 12 months old. In addition to venous blood samples, the study will also collect dried blood spots in a subset of the mothers and their infants (100 mother-infant dyads). This will be done at the same time as the venous blood draw. Both venous samples and dried blood spots will be analyzed for aflatoxin levels using validated assays. The data on maternal and infant/young child exposure levels to aflatoxin will be linked to the infant’s growth trajectory, and reported at a level of disaggregation by gender to determine differences in aflatoxin exposure in relation to growth between boys and girls. Data generated from dried blood spots will be validated with those generated from the venous blood samples. If valid, the use of dried blood spots will provide a low cost method to measure aflatoxin exposure. The Nutrition Innovation Laboratory-Asia is taking responsibility for undertaking the study, in close collaboration with the Child Health Division of the Ministry of Health and Population, the National

Agricultural Research Council, the Institute of Medicine (IOM) at Tribhuvan University, the Patan Academy of Health Sciences, Helen Keller International and the University of Georgia. The Child Health Division of the Ministry of Health and Population will facilitate district health service interactions. The Nutrition Innovation Lab-Asia local office, hosted by Helen Keller International, will provide day-to-day oversight and management of the research.

V1.2 Lessons learned from programs in Bangladesh and Cambodia that integrate aquaculture, horticulture and nutrition actions

Feed the Future's Learning Agenda (2012) states that there remain many unanswered questions regarding appropriate investments in agriculture for improving nutrition and diet quality. Two of the "key questions" posed by the Learning Agenda are: a) What have been the impacts of different approaches linking Agriculture, Nutrition and Health (ANH) on dietary diversity and nutritional status (i.e. geographic co-location of programs, integration of interventions, what combination of A, N, and H)?; and b) Have programs to increase farmers' incomes resulted in improved nutrition when not coupled with nutrition programming? (USAID 2012) Both of these questions are being addressed by research that will be conducted in Bangladesh starting in Y5, and that is under development in Cambodia. In partnership with the Horticulture Innovation Lab and AquaFish Innovation Lab, the Nutrition Innovation Lab-Asia is planning to implement an applied research study focused on the effects of combined aquaculture, horticulture and BCC activities. The proposed research agenda explicitly meets the high standards currently required for evidence-based practice, empirical documentation of impacts on nutrition, and serves as an umbrella for testing technology innovations as well as responding to locally-generated questions of pertinence to programs on the ground.

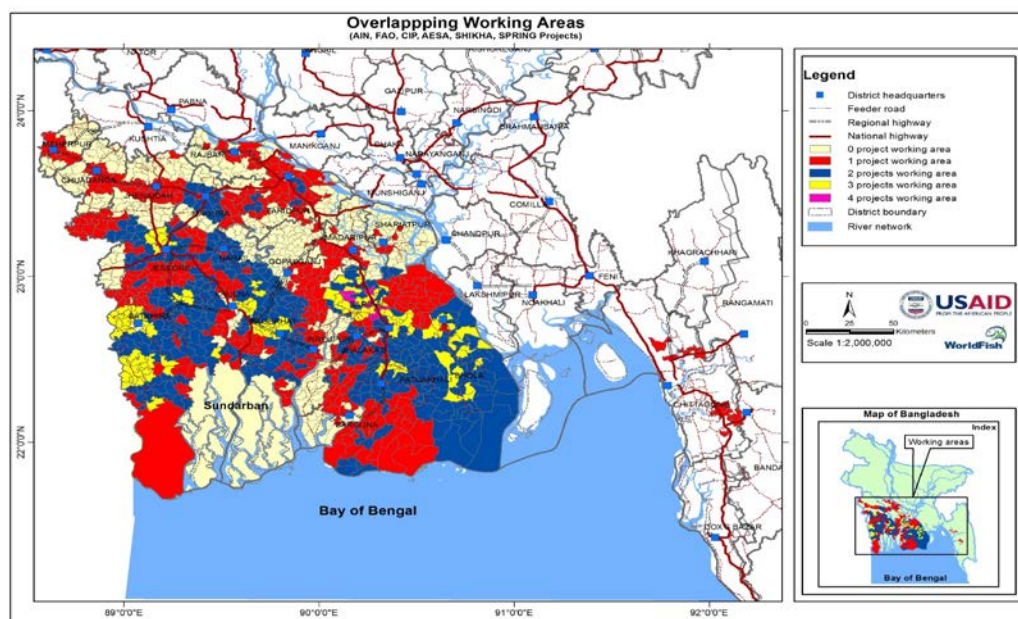
These studies do not represent an impact evaluation in the usual sense (of individual programs), rather a rigorous approach to examining effects at a zone of influence level by assessing the individually and collective gains among poor consumer (non-beneficiary) as well as producer households. The findings from this 4-year activity will contribute to enhancing the impacts of FTF investments, while also better informing Bangladesh and Cambodia priorities for agriculture investments to support nutrition in coming years. It will also serve as a basis for greater cross-innovation lab and inter-program engagement on key scientific questions relevant to the global development community.

V1.2.1 Bangladesh: USAID-supported programs in Bangladesh focus on improving the productivity of aquaculture and horticulture, with a view to enhanced nutrition among vulnerable populations. Linking the production and consumption of aquaculture products with nutrient-rich vegetables and fruits (such as orange flesh sweet potato and green leafy vegetables), while supporting knowledge and changed behaviors, could be a cost-effective and scalable strategy for sustained improvement of child nutrition. In the FfF zone of influence (Figure 1), there are multiple projects focused on improving income, consumption, nutrition and health in smallholder (including commercial) households reliant on aquaculture and horticulture. The projects all seek to promote greater supply, more sustained access (in markets), and enhanced consumption (both by producers and non-producing consumers) of food based approaches to achieving protein and micronutrient needs. Across FTF's zone of influence (which consists of Khulna, Barisal and Dhaka Divisions of Southwestern Bangladesh), there are 14 programs focused on nutrition and

agriculture or on nutrition coupled with agriculture working in overlapping geographic areas. Of these, five programs will participate in the collaborative research. They use different household targeting approaches, implementation designs, time frames for implementation and measures of success. This variability in programming approaches across contiguous geographic locations offers a basis for exploring the combined impacts of integrated interventions on diets and nutrition among poor consumers as well as producers. It also offers a unique opportunity to understand whether co-location of different integrated programs brings added gains to households exposed to the multiple programs.

The design of the study in Bangladesh is of a longitudinal prospective panel/cohort nature that will follow households across the USAID Bangladesh FTF zone of influence that were surveyed in a nationally representative baseline survey in 2012 (prior to the start of the existing programs). The 2012 baseline thus serves as a basis for understanding how the “existing” programs are contributing towards improvements in nutrition at a population level. The sampling frame and strategy are based on the national representative survey conducted by IFPRI in 2012 with a specific sampling of the FTF zone of influence. The study design thus will allow for unbiased results that accommodate secular trends (i.e. expected development regardless of intervention) and the co-existence of other (non-USAID) actions to which the same population may be exposed. Under the umbrella of the overall research, which will consider seasonality effects, value-chain developments, gender dimensions (how men and women’s roles differ in and are impacted by program-driven innovations in aquaculture and horticulture), and how nutrition and health knowledge and education translate into behavior change, the research will also rigorously test innovative technologies, including a new strategy for gardens floating on smallholder fish ponds, solar-powered cool rooms to extend the life of fresh fish, vegetables, and fruits, and chimney dryers.

Figure 1: Feed the Future Zone of Influence and project areas (including overlap).



Source: USAID Bangladesh

The programs within the USAID Bangladesh FTF zone of influence of particular interest in this applied research include USAID Shikha, USAID Spring, USAID AIN (Aquaculture for Income and Nutrition), UNICEF/FAO IAHBI and USAID CIP-Horticulture. Each program includes elements of agriculture (homestead food production, livestock production, aquaculture) and nutrition (infant and young child feeding, behavior change communication) and health (hygiene, sanitation, reproductive health) interventions in targeting the beneficiary populations. The study will be conducted across the same representative sample of unions as the FTF baseline survey which are exposed to between one to five different programs. Two panel surveys will be conducted annually (to capture seasonality) with data being collected on agricultural production and practices, diet intake and diet diversity and anthropometry across three different groups: households exposed (producer or non-producer) to a single program (Group 1), households exposed to two or more programs (Group 2), and households that are not exposed to any program within their union (Group 3).² The groups will be further stratified into households that are producers (direct program beneficiaries) and consumers (indirect beneficiaries of ongoing USAID programs). A fourth group of 9 unions will be utilized to test three innovative technologies for improving horticulture and aquaculture productivity and value chains (3 unions per technology). In the analysis of the data collected (per panel and across panels), the study will use propensity score matching to match the households in the non-intervention group (Group 3) to households in Groups 1 and 2 and examine the strength of comparability in the exposed (Groups 1 and 2) versus non-exposed population (Group 3). The Group 3 households will also include producers, even if they are not part of current USAID programs since the whole region already includes many farmers engaged in aquaculture and/or horticulture. Additionally, there will be many consumers of aquaculture and horticulture products in these locations who are not direct beneficiaries of USAID interventions (given the absence of current interventions in their area). As this is a repeat/longitudinal panel (cohort) design, the same households will be visited in each panel.

V1.2.2 Cambodia: In Cambodia, USAID mission investments have focused on promoting productivity growth, innovation and scaling-up of key commodities that generate income and have potential to support enhanced nutrition outcomes of women and children, including aquaculture and horticulture linked to the almost ubiquitous cultivation of rice. While promoting greater output, marketing and consumption of such foods, USAID also supports changed behaviors at the household level that would enhance breastfeeding, improve sanitation and hygiene practices, and childcare. Some of these various elements are already integrated programmatically in the ongoing HARVEST activity, while additional (complementary) interventions are planned through a new program called NOURISH. That these programs and their various multisector components would collocate geographically in some parts of the Cambodia Zone of Influence but not all offers an unusual opportunity to consider the population-wide effects on nutrition of single intervention, combined intervention and no intervention. As

² Of course, even in Group 3 (no current USAID intervention) sites there will be households who are currently, or have in the past been, engaged in aquaculture and/or horticulture activities. This does not invalidate the comparison between current FTF program intervention sites and non-intervention sites, given FTF's stated goal of zone-wide (population-wide) impacts on nutrition. In other words, although the current activities and diets of households in non-program zones are reflective of past and ongoing government policy or non-USAID programmatic influences, their nutrition outcomes in these areas need to be measured since they make up part of FTF's Zone of Influence.

noted in FTF's Learning Agenda (USAID 2012), two of the "key questions" that need answering to support improved programming are: a) What have been the impacts of different approaches linking Agriculture, Nutrition and Health (ANH) on dietary diversity and nutritional status (i.e. geographic co-location of programs, integration of interventions, what combination of A, N, and H)?; and b) Have programs to increase farmers' incomes resulted in improved nutrition when not coupled with nutrition programming? (USAID 2012) These questions are addressed by the current research proposal. The research will build on an ongoing randomized control trial (RCT) that will help understand if combined homestead gardening with aquaculture has impact on nutrition (Green 2013). The research will add on to the RCT findings by examining the following questions which cannot be addressed by RCT: a) If an impact is seen, through what mechanism (how) was it achieved? b) What is the relative contribution of capture fisheries, horticultural crop production and non-agricultural income sources to the total net diet of poor households? c) How do poor non-producing households benefit from higher productivity (availability in the market) of aquatic and horticultural products? d) What tradeoffs might there be in terms of labor demands and opportunity costs of time for women versus men in household adoption of packages of aquatic production and horticulture, in addition to other elements of agriculture? and e) What additional benefit for nutrition is gained through targeted health and behavior change investments over and above gains in agriculture.

The research uses a longitudinal observational cohort/panel design. A stratified random sample will be generated to determine statistically significant changes in nutrition outcomes among producing households versus non-producing households over time, and among households where programs were co-located versus households exposed to either one program alone or no program. The study will thus aim to compare households that are exposed to USAID HARVEST alone (Group 1), exposed to both USAID HARVEST and NOURISH (Group 2) and those that are non exposed (yet within the Zone of influence) (Group 3). A separate but concomitant pilot activity will examine the effect of introducing three novel technologies (cool rooms and chimney dryers initially and possibly in the future floating gardens) to producer households on income, consumption and nutrition outcomes of the producer households and consumption and nutrition outcomes of consumer households that are likely to benefit from the outputs of the technologies. This latter activity is supported through the core funds of the Horticulture Innovation Laboratory.

VII) Human and Institutional Capacity Development

VII.1.1 Individual training: The Nutrition Innovation Lab-Asia continues to support Nepali academics and students for both short-term and long-term support. Short-term support includes short courses and workshops:

- *Short-Term*: A total of 103 individuals were trained in child health and nutrition topics through short-term support of the Nutrition Innovation Lab-Asia. These included 23 women and 80 men. Types of training included nutrition research methods workshop held in Bangalore, India in January 2014 and the research symposium, Innovation Council meeting, training of enumerators and government dissemination meeting and the non-degree summer training at Cornell University.

- *Long –Term:* There are 4 men and 3 women in long-term training (PhD and Masters) at Tufts University, Johns Hopkins School of Public Health and Tuskegee University.

VII.1.2 Institutional development: A key issue that has been consistently observed in Nepal is the lack of formal education not only in cross-disciplinary policy-relevant theory and practice, but also in basic nutrition and dietetics. The Nutrition Innovation Lab-Asia continues to work on institutional development where possible:

- The Nutrition Innovation Lab-Asia continues to facilitate local stakeholder discussions at several institutions on the development of a curriculum for an MPH/MS degree in nutrition at the Institute of Medicine (Tribhuvan University) as well as Patan Academy of Health Sciences and private teaching institutions.
- The ME plans to use core funding to support the the Nepali faculty at the Institute of Medicine and the Patan Academy of Health Sciences to develop and implement a short 2 week nutrition research methods training course for students and academics in Nepal, along the lines of the course implemented at St. Johns Medical College in Bangalore (BBNC). A proposal to the USAID/Nepal mission was not supported, so support will be provided for the first year by core funds from the Nutrition Innovation Lab-Asia which will kick-start the process. There have been discussions by Patan Academy’s Vice Chancellor with the Vice President and Director of the Public Health Foundation of India, and Director of the Indian Institute of Public Health to gauge their interest in supporting a ‘regional’ initiative along these lines. The report is that they are very enthusiastic about such a collaboration, and therefore the ME will continue to see this as a very important training initiative in Y5.
- The Nutrition Innovation Lab-Asia continues to support the Ministry of Health and Population’s Child Health Division in its strategic planning for a national nutrition surveillance system by supporting meetings, sharing best practice examples and reports, and interacting on an ongoing basis with ministry and donor agency staff.
- Institutional development has taken place among local non-governmental organizations in a variety of ways, including presentations on methods, training support for technical staff, and on-going interaction with M&E professionals at the Nepal-based offices of Save the Children, Helen Keller International, and IDE, that are key to the effective management of various kinds of USAID-supported development activities across Nepal.
- The Nutrition Innovation Lab-Asia has supported training of local NGO staff (enumerators and data collectors) in nutrition, health and agriculture. Similarly, the Nutriton Innovation Labs’ ME and partners have allocated considerable effort to providing technical support to key US-based partners, such as SPRING, by supporting global and regional training and knowledge dissemination activities that seek to build capacity within USAID and its partner organizations to better implement, measure and learn from Feed the Future strategies.

VIII) Technology Transfer and Scaling Partnerships

Unlike other Innovations Labs, which focus on generating new varieties of seeds, techniques for pest control or tools for market analyses, the Nutrition Innovation Labs’ (Asia and Africa) main intellectual property relates to dissemination of research findings that directly impact policy and

program design, and the methods of implementing both. The one technology transfer that may represent an important step forward in research in Nepal is the programming and use of electronic tablets for implementing surveys in the field. While this has already been done in the context of Demographic and Health Surveys, it has not been extensively used a) in the context of interviews relating to policy processes at all levels of governance, and b) in the remotest parts of the country, including the Western Mountains. Documenting the process, cost and time-savings involved in tablet-based data collection will represent an important upgrading of local research capabilities in-country.

IX) Governance and Management Entity Activities

The ME tasks for Y4 of the program were implemented smoothly by Tufts. Research and training funds were almost exclusively disbursed among the many partners. . As planned and budgeted for in the Y4 workplan, the ME was able to successfully:

- Organize field trips for participants of the Innovation Lab Directors' Council meeting in Kathmandu (March 2014)
- Organize field trips for, and interact extensively with, the External Evaluation Team (EET) tasked by USAID to review the Nutrition Innovation Labs (Asia and Africa) and offer recommendations regarding potential extension into a second phase and actions required to address weaknesses in areas of management, research, finances and/or capacity building. The ME responded formally to the overall positive evaluation report of the EET and thanks USAID for setting up and overseeing the review process.
- Host one Board of Directors (BOD) and one Technical Advisory Committee (TAC) meetings in September 2014. The TAC focused on examining the direction of the Nutrition Innovation Labs (Asia and Africa) research, with a focus on successes and potential weaknesses identified by the EET. The BOD focused on potential future directions for the Nutrition Innovation Labs, and how to enhance dissemination of results so far.
- The Nutrition Innovation Labs' website was restructured and enhanced, with a formal 're-launch' planned for early in Y5. This responds to one of the important negative comments made about the Nutrition Innovation Labs in the EET.

In addition to the governance and management activities, key events were hosted by the Nutrition Innovation Lab-Asia in several global scientific meetings:

- The 2nd Annual Scientific Symposium, that took place in Kathmandu in Y3, served as the basis for planning a 3rd such event for November 2014. The ME's core partner in Nepal, Johns Hopkins University, took the lead in planning, in collaboration with local academic partners. The 3rd Symposium has been designed a) to attract more participation than the first two events, b) a special workshop session has been planned on 'what constitutes rigorous evidence to support policymaking', and c) an additional workshop is planned for Nepali students (a peer-reviewed poster session).The Nutrition Innovation Lab organized two successful Innovation Lab Directors' Council meetings – one in Kathmandu in March 2014, which brought together mission representation from the region and high-level representatives from USAID/Washington; and the other in Washington, D.C., in September 2014, which also included a large reception in the Senate and interaction with

staffers and congressional and senate representatives. Several other events, conferences and fora were used by the Nutrition Innovation Lab-Asia for the presentation and dissemination of research and capacity building activities. A list of events, presentations and the numbers reached are provided in Appendix 2.

X) Other Topics (impact assessment, gender initiatives)

Not applicable

XI) Issues (financial, management, regulatory)

In Y4, the ME was able to award more than 65 percent of the total Nutrition Innovation Lab-Asia award to direct work in Nepal. Again, as in past years, the majority of the ME labor is allocated to cost share and is not part of the main labor budget. Key positions such as the Associate Director, Program Manager, and a major share of the Programs Director's salary is provided as cost share. The majority of the funds were given to our partners to be used toward capacity building and research in-country. Some of the other major expenses were dedicated to costs associated with promoting and disseminating Nutrition Innovation Lab-Asia research results such as the workshop the ME sponsored at the Nutrition Congress in Spain and the Metrics Workshop in conjunction with the Experimental Biology Conference. This year we sponsored a Nepal student to begin his MS program in Food and Applied Nutrition, and we supported six students from Nepal to attend the Bangalore-Boston Nutrition Collaborative research workshop in India.

XII) Future Directions

The core foci of the Nutrition Innovation Lab-Asia research will continue into Y5. The longitudinal panel will continue to build, the policy process work will become sharper, and the other ongoing studies will bear fruit that informs the Feed the Future initiative's agenda. Furthermore, important analyses of secondary datasets will continue (see Success Story No. 2 below), and new elements of Nepal-based studies (aflatoxin cohort and frontline workers surveys) as well as Associate Award work in other countries (Bangladesh and Cambodia) will enhance Nutrition Innovation Lab-Asia visibility and impact across Asia.

Capacity building will remain central to the Nutrition Innovation Lab-Asia agenda, and there is the possibility of linking Nutrition Innovation Lab-Asia research to upcoming activities to be supported under Title II programming of the Office of Food for Peace. Those opportunities will continue to be explored now that the main activities have been awarded.

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Appendix 1: List of awards to U.S. universities

1. *Johns Hopkins University*: PoSHAN Community Research (includes local partners, Institute of Medicine, Nepal Agriculture Research Council, New Era and Nepali Technical Assistance Group), 2012 - 2014, \$629,000 in Y4 1,842,796 total)
2. *Harvard University*: (includes local partner Institute of Medicine), Mother-Infant Pair Follow Up, 2012 – 2014, \$130,000 in Y4 (\$405,683 total)
3. *Purdue University*: Understand and measure the connections between agricultural capacity, technology adoption, nutrition outcomes, and conditioning factors at levels of aggregation ranging from household to district level. \$79,584 in Y4 (\$312,074 total)
4. *Tuskegee University*: \$51,304 in Y4 (\$139,376 in total)

Appendix 2: List of presentations made on Nutrition Innovation Lab – Asia research activities

Presenter	Event	Place	Title	Date	Size of Audience
Webb, P.	Participants of the UN technical preparatory meeting for ICN2	FAO, Rome	Enhancing policy commitments for nutrition	Nov 2013	100
Webb, P.	Participants of Tata-Cornell Institute workshop of agriculture for nutrition metrics	Cornell	Minimum Nutrition Datasets	Nov 2013	30
Webb, P.	Agrilinks Webinar	Boston	Incorporating Nutrition into Feed the Future Research Programs	Feb 2013	80
Webb, P.	AAAS (annual science meeting)	Chicago	Impacts of Agriculture on Nutrition: Nature of Evidence and Research Gaps	Feb 2014	75
Webb, P.	Innovation Lab Directors, USAID/DC staff, local partners, government	Kathmandu, Nepal	Overview of Nutrition Innovation Lab-Asia's research agenda in Nepal	March 2014	50
Webb, P.	Save the Children	Kathmandu, Nepal	Keynote address: Are we there yet?	March 2014	250
Webb, P.	Hidden Hunger Congress	Stuttgart, Germany	Deficiencies in our Understanding of Micronutrient Distributions	March 2014	350
Webb, P.	Local Innovation Lab Pls, mission staff,	Dhaka, Bangladesh	Overview of Nutrition Innovation Lab-Asia's research agenda	April 2014	35
Webb, P.	Mission staff, local stakeholders, researchers	Phnom Pen, Cambodia	Agriculture's Role in Nutrition	April 2014	30
Webb, P.	Friedman School Board of Advisers	Boston	Research under the Feed the Future Nutrition Innovation Laboratory	May 2014	12
Webb, P.	Pulses Innovation Lab	Athens, Greece	Incorporating Nutrition into Feed the Future Research Programs	May 2014	100
Webb, P.	LCIRAH conference	London, UK	Could Cross-Sector Collaboration Affect the Fidelity and Impact of Food and Nutrition Policies?	June 2014	150
Webb, P.	Webinar to Friedman School alumni and donors	Boston	Are we there yet? Trends, Opportunities and Challenges for Global Nutrition post-2015	June 2014	48
Webb, P.	Child Health Division, Ministry of Health, Nepal	Kathmandu	Dissemination of first PoSHAN process findings to policymakers, researchers and partners	Aug 2014	38
Webb, P.	A4NH/Science Council of the CGIAR workshop	Washington	Multi-indicator Indices of Nutrition (as a tool for enhanced policy and planning)	Sept 2014	40
Additional Presentations	IN INDIVIDUAL PARTNER REPORTS				

Appendix 3: Papers produced during FY14

Published

1. Masters W, Webb P, Griffiths J and Decklebaum R. 2014. Agriculture, Nutrition and Health in Global Development: Integrated Intervention Designs Call for Integrated Research Methods. *Annals of the New York Academy of Sciences*. doi: 10.1111/nyas.12352.
2. Lapping K, E. Frongillo, P. Nguyen, J. Coates, P Webb and P. Menon. 2014. Organizational factors, planning capacity, and integration challenges constrain provincial planning processes for nutrition in decentralizing Vietnam. *Food & Nutr. Bulletin*. 35 (3): 382-91.
3. Baumann, S-M., P. Webb and M. Zeller. 2013. Cross-Cultural Validity of Food Consumption Indicators—Moving Towards Standardization. *Food & Nutr. Bulletin*. 34 (1): 102-19
4. Webb, P. 2013. Afterword: Now is the Time. In, Kraemer K (ed.) *Hunger: An Updated Compendium*. Sight and Life: Zurich, Switzerland, Chapter 13.
5. Webb, P. 2013. Editorial: The Prize and the Price of Good Nutrition. *Journal of the Institute of Medicine (Nepal)*. 35 (3): 1-3.
6. Henjum, S., Manger, M., Skeie, E., Ulak, M., Thorne-Lyman, L. A., Chandyo, R., Shrestha, S. P., Locks, L., Ulvik, J. R., Fawzi, W. W., Strand, A. T. 2014. Iron deficiency is uncommon among lactating women in urban Nepal, despite a high risk of inadequate dietary iron intake. *British Journal of Nutrition*, 1-10.
7. Brown, E, M., Grace, K., Shively, G., Johnson, B, K., Carroll, M. 2014. Using satellite remote sensing and household survey data to assess human health and nutrition response to environmental change, *Population and Environment* 36: 48-72.
8. Jagger, P., Shively, G., 2014. Land use change, fuel use and respiratory health in Uganda. *Energy Policy* 67: 713-726.
9. Thorne-Lyman, A. 2014. Letter to Editor: Is the strength of association between indicators of dietary quality and the nutritional status of children being underestimated? *Maternal and Child Nutrition*, 10: 159-160.

Unpublished Reports and Briefing Papers

- Webb P., S. Ghosh, S. Musulmatan, J-S Wang, S. Gurung and J. Griffiths. 2014. *Nutrition Implications of Aflatoxin Exposure: An Analysis of Mothers and Children in Timor-Leste's Food and Nutrition Survey*. A report to UNICEF and Australian Aid, July 31, 2014.
- Webb, P., Ghosh S., Sapkota D., Davis D., Kennedy E., Gurung S., and Baral K. 2014. Governance of Nutrition Policies and Programming: Preliminary findings from PoSHAN process research in Nepal. *Nutrition Innovation Lab Research Brief* No. 15.
- Webb, P., Ghosh S., Sapkota D., Gurung S., Davis D, Baral K. and Pandey Rana P. 2014. Perceptions and Practices Relating to Nutrition Among Decision-Makers at Suaahara sites of Nepal. *Nutrition Innovation Lab Research Brief* No. 16.
- West K., et al. 2014. *Baseline Summary Report of the 1st Annual Panel Survey 2013: PoSHAN Community Studies*. Johns Hopkins University, Baltimore, MD.

Appendix 4: Success Story No. 1

(photocredits: Diplav Sapkota)

Turning to Tablets: New Technology Makes Research More Timely and Cost-Effective

A common complaint made by programming professionals and policymakers about research is that ‘it takes too long for results to be shared’. It is often felt that this time-lag constrains real time corrections that could be made to interventions in the field, or to the design of strategies at the national level. Speeding up the process of collecting data is usually not an option. There are no short-cuts to conducting in-depth interviews using complex survey instruments with multiple respondents in remote locations. Human interactions must be respectful, ethical and mindful of respondents’ time. But the recording of data collected, the time needed for corrections and quality control, and the transmission of datasets to analysts who can more quickly conduct analyses useful to policymakers *can* all be accelerated – by shifting from paper-based surveys to electronic tablets.

The Nutrition Innovation Lab in Asia has done just that. Its research on *how* programs and policies are actually implemented in Nepal (the policy process research arm of the PoSHAN research agenda – Policy and Science for Health, Agriculture and Nutrition), moved to tablet data capture for the second round of interviews conducted in mid-2014. The first round, involving almost 800 interviews in 21 field sites spread across the entire country, took almost seven months from start to finish. That is, once the survey instruments had received local approval in 2013 from Nepal’s institutional review board, enumerators were trained and then headed to the field in teams for roughly one month of actual interviews. Once the large packets of paper-based questionnaires had been completed and shipped back to Kathmandu, the process of coding, data entry, and cleaning took more than 2 months to complete.

The use of android tablets programmed with the same questionnaires ahead of time, significantly increased the turn-around time. For the second round in 2014, data were entered into the tablets and results uploaded to Kathmandu on a daily basis, when internet connectivity allowed. This permitted real-time verification of data quality and a much faster (less than one month) access to clean, verified data. While the purchase and programming of tablets carries an up-front cost, they are more cost-effective than paper after just two survey rounds. In other words, not only can the data be shared with stakeholders more rapidly, the adoption of advanced technology for conducting such research promotes cost-savings in the longer run and builds capacity in-country for future use.

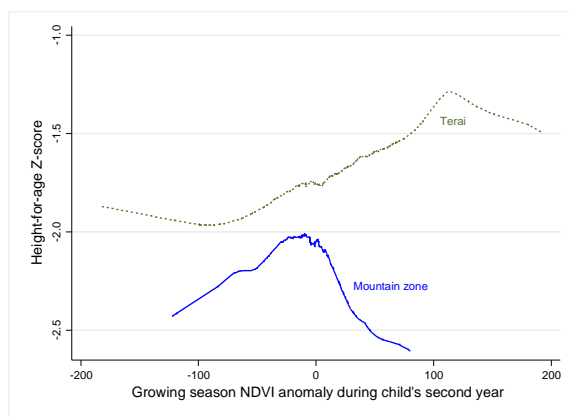


Success Story No.2

It is Rocket Science: Collaboration between NASA and US Universities Sheds New Light on Nutrition Problems in Nepal

Under the auspices of the Nutrition Innovation Lab for Asia, a major effort has been underway at Purdue University to measure connections between child growth and a wide range of determinants believed to influence health and nutrition. In collaboration with Tufts University, the University of North Carolina and numerous in-country partners, including Nepal's Central Bureau of Statistics and the Ministry of Agriculture, Purdue researchers (including a Nepali student pursuing a PhD at Purdue) have linked remotely sensed satellite data recorded over the past decade by the Global Inventory Monitoring and Modeling Systems (GIMMS) group at NASA's Biospheric Sciences Branch with Nepal-wide datasets relating to agricultural output, food prices and nutrition. This approach represents a leveraging of past investments in the collection of "big data", and takes advantage of new opportunities afforded by the use of georeferenced data.

Dr. Gerald Shively, leading this effort, has been working closely with Dr. Molly Brown, a NASA scientist, on such efforts. They matched GPS (geographic positioning system) coordinates and local crop calendars between 2006 and 2011 to identify the extent to which vegetative growth (how 'green' the landscape is due to rainfall and temperature levels) is linked to the growth of over 2,300 children under five years of age. The greenness index (the Normalized Difference Vegetation Index, or NDVI) is commonly used in famine early warning systems, but has not been widely used to explain patterns of malnutrition across the diverse agroecologies of a country like Nepal. They find that agriculture patterns, determined in large part by rainfall, have an important role to play in nutrition. How important depends largely on the season of the child's birth relative to harvest season and that year's productivity of local staple foods; or, conversely, anomalies in harvests linked to anomalies in climate.



The figure shows NDVI anomalies (i.e. departures from normal growing conditions) against child stunting outcomes for 2 distinct agroecological zones of Nepal: the southern plains adjacent to India (the terai) and the high mountains. The zero point on the horizontal axis represents 'normal', while the vertical axis shows malnutrition in relation to NDVI anomalies. The results suggest potential challenges that Nepal could face if climate change substantially shifts growing conditions and crop responses. In the terai, nutrition outcomes could be either positively or

negatively affected by shifts in growing conditions, depending on the direction of environmental change and vegetative response. By contrast, in the mountains, child nutrition appears more sensitive to departures from normal growing conditions, with mostly negative results. This ongoing research seeks to assess the robustness of such findings and to better understand the mechanisms at play and potential policy responses.